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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

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The Age of Specialisation.

It is a truism to say that with the growing complexity of modern industry an ever higher degree of specialisation is demanded of its workers; but it is less widely realised that this is only a symbol of a tendency which runs right through the life of to-day. It cannot be denied that life in all its manifestations is becoming increasingly complex. Witness, for example, the endless multiplication of governmental organisation, central and local alike: the daily increasing bulk of scientific knowledge; the spread of elaborate labour-saving devices in the home, and so forth. And since the human capacity for knowledge and for experience is, after all, limited, the result is inevitably a tremendous growth of specialisation.

It is common in some quarters to regard specialists and specialisation with some slight suspicion, and to prefer general intelligence and common-sense to a high degree of training. This attitude of mind may be justified to some extent by the obvious fact that the more time a man devotes to the acquisition of knowledge in one special field the less time is left for him to devote to knowledge in any other field, so that it is not unreasonable to say that the more a man knows of one thing the less he probably knows of everything else. (It may be remarked, in parenthesis, that the converse is not necessarily true, as a high degree of specialisation demands a high degree of mental ability to begin with.)

There exists also a prejudice—rather more easily understood—in favour of jobs that involve learning and performing a complete process, as opposed to the mechanical repetition of one small fraction of a process.

But, unfortunately, all these prejudices and suspicions run counter to the inevitable line of development to-day. Once upon a time it was possible for a man to know everything within the broad limits of the subjects that interested or concerned him; or to perform every task in the production of a finished article. To-day this is an impossibility. Knowledge, even on the most restricted of subjects, is continually being enlarged, while articles made by a single pair of hands are playing a diminishing part in the world's work, although they are still frequently valued for reasons other than their utility. Specialisation has come to stop, and life will inevitably become not less specialised but more specialised, until the general labourer and the general clerk and the general servant have vanished to be replaced by a host of expert specialists, each performing a few duties in highly skilled fashion.

The process is accompanied by serious dangers. The single-track mind of the specialist is proverbial, although in fairness to the specialist it must be said that it is by no means universal; and the deadening effect of repetition processes on the operatives in industry has been the subject of many searching conferences among phychologists and sociologists. This can only be fully compensated if the increase of specialisation is accompanied by a speeding up of production, leading to a shortening of the hours of labour, and so to an extension of leisure-time in which the specialist may desert his speciality. If it be accompanied by some such development, then the increase of specialisation need cause no great alarm.

Crumbs by the Way-side.

When we leave these shores for our annual vacation we find that we cannot altogether cut ourselves adrift from the foundry industry, and during a recent trip up the Rhine we took the opportunity of renewing our acquaintance with the Lanz concern, and of inspecting the metallurgical department of the Technical High School at Aachen. At the Mannheim foundry we found that much progress had been made since our last visit some two years ago, especially with the production of "Perlit" castings and the cleaning of castings in general. New mould-heating stoves have been erected, which appeared to be excellently regulated by means of a rather elaborate pyrometric system. It appears that all moulds are taken to exactly the same maximum temperature, and cooling-time curves have been prepared for each weight or volume of sand, and casting is effected at the correct time. Their "mortuary," divided into two sections, one for foundry defects and the other for machining faults and breakages in handling, was nearly empty, whilst an examination of the work in progress showed that waster castings were few and far between. Figures need much auxiliary data before general acceptance, but compared with the conditions existing two years ago, real solid progress had been made. Many castings which here would be made in malleable, but for which steel has been generally used in Germany, are now being made successfully in this hot-mould iron.

The development in the fettling shop related to utilisation of two, and the preparation for the installation of an additional four units, of high-pressure water-cleaning cabinets, very much after the style of a sand-blast installation. That it was effective we certainly assured ourselves; that it was economic under local conditions we had to be guided by the progressive installation of more units.

We are indebted to Dr. Ing. Piwowarsky for giving us the privilege of inspecting his department of the Technical High School at Aachen. Its equipment is brilliant, the character of its researches are well known and appreciated throughout the world, and, what is more, it is overcrowded with students; whilst, in common with all other similar institutions, the professor and staff grumble about the lack of available funds, the existing equipment has the appearance of being used, and in some cases almost overworked. For instance, arrangements exist in a number of apparatus for the continuous introduction of specimens, without stopping work. We were so impressed with the school that we intend to make it the subject of an article which should form an interesting addendum to those now appearing from the pen of Mr. Fox Allin.

XUM

The 58th Annual Meeting of the German Ironfounders' Employers' Federation.

Foundry Problems of the Present and the Future.

The Verein Deutscher Eisengiessereereien, Giessereiverband, held this year's annual meeting on June 15-17, in Danzig, Dr. Werner, of Düsseldorf, being in the chair. Members attended from all over Germany, and there were present also the representatives of various official departments, Technical High Schools, and Schools of Mines, together with delegates from interested associations and institutions in Germany and other countries.

In the afternoon of the first day, which was devoted to ironfoundry technology, there was delivered an interesting lecture by Dr. Geilenkirchen, of Düsseldorf, one of the Association's leading personalities, dealing with present day and future foundry problems.

Lost Ground Recovered.

After a brief review of the utilisation of cast iron in earlier years, in which he showed that, at the beginning of the century, cast iron had been more and more displaced, where tensile strength was required, by steel castings, he referred to the fact that, as a result of recent efforts to improve the quality of cast iron, the latter had won back from cast steel the major portion of the lost ground. The test results which could now be achieved with cast iron, even if they did not equal those obtainable with steel castings, did fulfil what was required and at considerably less cost.

Of late, continued Dr. Geilenkirchen, light alloy castings are beginning to be used for many purposes in place of cast iron, while in the manufacture of electrical machinery, heavy cast-iron castings have been very largely replaced by welded sheet-steel constructions.

Under these circumstances, the fundamental problem of modern ironfoundry technology (upon the solution of which the vitality of the foundries depends) lies in so conducting the melting and casting processes as to turn out iron castings having properties adapted in the highest conceivable degree to the specific use to which they are to be put.

The lecturer dealt with the considerable progress which has been made during the last ten years or so in the production of high quality cast iron, attributing the lead to German firms. Especially has it been possible, by study of the microstructure of iron-carbon alloys containing graphite, to discover the conditions under which there is produced a cast iron standing high in respect to mechanical properties, with a uniformly fine-grained structure throughout, and of great density—and, by reproduction at will of these conditions, to provide a practical solution to the problem of the manufacture of such high-grade cast iron.

The Lanz Perlit, the Krupp "Sternguss," the "Thyssen-Emmelguss," the manufacture of cast iron having the graphite in a state of extremely fine sub-division by the Schüz process and according to the researches of Prof. Piwowarsky and Prof. Hanemann, or the manufacture of superheated cast iron in the Wüst reverberatory furnace are characteristic of the very general progress made in the production of high-quality cast iron.

High Temperatures in the Melting Furnace.

In all these processes it has proved essential to superheat the metal, after melting, to high temperatures, such as had not been usual previously in foundry practice. Thus the problem of the manufacture of high-grade cast iron largely resolves itself into the production of high temperatures in the melting furnaces.

There are modern melting furnaces in which these high temperatures can be achieved without difficulty, but, besides gradually introducing these furnaces, it is necessary to devote attention to the running of the usual foundry melting-furnace, the cupola, in such a way that the requisite superheating of the cast iron can be carried out therein with the employment of the minimum quantity of coke.

This problem, also, can be said to be now solved in practice even if the details of the ideal cupola for this purpose are not yet scientifically established and there is as yet no unity of opinion concerning the best design and arrangement of the accessory plant, especially of the plant for the production and supply of the blast. Future investigations will have as their goal the solution of these still open problems.

Mould Drying.

A further question of heat technology involved in foundry work is that of the most suitable form for the mould-drying equipment. The shortage of fuel after the war and the economy everywhere necessary had a beneficial effect on the evolution of drying stoves which would achieve their purpose with low fuel consumption, but the questions still remain unanswered as to the degree to which the drying of the moulds must be carried and upon what scientific laws the drying process rests. Only when these problems (to which the German Ironfounders' Association has energetically applied itself, organising a successful competition and large scale experiments all over Germany) have been solved will it be possible to extend to the whole industry the successes of individual practice.

Green-sand moulds are gaining in importance, and American, as also a large number of German foundries, have had great success in this direction, the work being accelerated and better utilisation of the floor area and considerable increase in output being obtained. It is still necessary, however, to render these developments available for a considerable number of foundries, and, above all, to extend the scope of a process, suitable in itself for only thin-walled castings, to heavier work.

This is primarily dependent on the use of a suitable moulding sand. Germany possesses a number of beds of excellent moulding sand, but it is necessary to ascertain, on the one hand, the requirements in the way of refractory properties, firmness when moulded, and permeability to gases, and, on the other hand, to what extent these characteristics are possessed by the naturally occurring moulding sands. This, so that, by suitable classification and preparing of these sands, mixtures appropriate for various purposes can be prepared.

Machine Moulding.

Moulding was formerly performed entirely by hand, but with the advent of "mechanisation" in the foundry there developed methods of mechanically ramming moulds by pneumatic rammers, squeezers, jar rammers or sand-slingers. Which of these methods is best suited to any specific purpose has hitherto been largely decided according to personal impressions, and there lies here the task of scientifically investigating the operation of the various moulding processes and replacing the present inexact ideas by exact calculations.

Similar remarks apply to the core-moulding machines. In the core shop a considerable increase in output can be obtained through the use of green sand and oil sand; in the employment of both types of sand, American foundries are, on the average, ahead of the German.

With regard to the pouring of the molten metal into the finished moulds, the two most important points are the proper arrangement of gates and risers and the selection of the correct pouring temperature. Both are matters still in the hands of the experienced foreman, and they provide plenty of ground for future scientific research.

Specialisation Essential.

The solution of the majority of the problems mentioned will show that conditions are fundamentally different with different types or classes of castings, and if foundries wish to fulfil the conditions requisite for quality and cheapness in production they can only do so by limiting themselves to certain classes of work. Such specialisation, however, pre-supposes careful investigation and calculation of the manufacturing conditions and costs of the various types of castings so that the foundry can determine what class of casting it can sell at a profit.

Material Handling and Time Studies.

When once specialisation has been entered upon it will be found possible, owing to the greatly reduced variety of patterns, to introduce modern methods of speeding up production and reducing costs. In this connection the transport problem is worthy of special attention as, in the foundry, the handling of materials of all kinds plays a big part in relation to the value of the product. By carrying out time studies the causes of time wastage must be ascertained and eliminated. Psychological tests applied, not only to apprentices who are just to be introduced to foundry work, but also to the moulders and other workers who are being engaged, will contribute to the maximum being obtained from the employees without the latter being overworked.

The solving of these many-sided and far-reaching problems, concluded Dr. Geilenkirchen, will be a profitable aim for the rising generation of foundry engineers, whose devotion to the work will be tested to the utmost. Even if years of endeavour are involved before the goal can be reached, efforts should not be relaxed, for only by such steadily pursued work will the ironfoundry industry permanently retain its vitality.

New Companies.

Guy & Company, Limited, 21, Tempest Hey, Liverpool.—Capital £1,000. Steel and ironwork contractors, etc. Permanent governing director: J. E. Guy.

Brown & Ward (Lathes), Limited, Warwick Road, Tyseley, Birmingham.—Capital £1,000. Mechanical and general engineers, etc. Director: J. R. Sambidge.

F. King & Company (Bath), Limited, Park Street Mews, Bath.—Capital £1,500. Engineers, iron and brass founders, etc. Directors: F. King and L. F. Skeats.

Johnson Playfair & Company, Limited.—Capital £12,600. Wire drawers, manufacturers and merchants, etc. Solicitor: D. S. Branson, 9, Bank Street, Sheffield.

W. A. Kellaway & Company, Limited.—Capital £3,000. Structural engineers, etc. Directors: S. H. Hume and J. McClelland. Solicitors: Morris, Ward-Jones, Kennett & Company, 19-21, Moorgate, London, E.C.

Iron and Steel Output in June.

The National Federation of Iron and Steel Manufacturers report that the number of furnaces in blast at the end of June was 141, a net decrease of seven since the beginning of the month, three furnaces having gone into blast and 10 having ceased operations. Production of pig-iron amounted to 563,700 tons in June compared with 591,500 tons in May, and 651,300 tons in June, 1927. The production included 181,200 tons of hematite, 203,800 tons of basic, 144,500 tons of foundry and 20,700 tons of forge iron. The output of steel ingots and castings in June amounted to 709,500 tons compared with 752,700 tons in May and 747,300 tons in June, 1927.

B.S. Specification for Drills.—A specification for twist and straight flute drills has just been issued by the British Engineering Standards Association. It contains tables giving the standard diameters, overall lengths and flute lengths for the various types of drills, and the dimensions of the Morse taper shanks. Standard limits are laid down for the permissible variation in the diameter of the drills, and performance tests are specified for both carbon and high-speed drills up to 2-in. diameter inclusive. Copies of the specification (No. 328—1928) may be obtained from the Publications Department of the Association, 28, Victoria Street, Westminster, S.W.1. Price 2s. 2d., post free.

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Black-Heart Malleable Castings.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—Mr. Evans and Mr. Peace deserve congratulating on their Paper on the production of black-heart malleable castings. It is an excellent example of a practical man and a chemist working together as under one hat, and Messrs. Ley's have been exceedingly good in allowing so many details of their process to be published. The discussion has been equally interesting, as also have been the replies of the authors.

The authors rightly point out that an iron which would readily graphitise did not make a good white-heart, and an iron which would not easily graphitise would not make a good black-heart. It is equally true to say that an unannealed black-heart casting of 25 years ago, annealed under present conditions, would not give the results obtained by the authors, nor would a present-day unannealed black-heart casting give the same results as were obtained under the conditions of annealing existing 25 years ago.

Progress has been made in the manufacture of black-heart castings, and it is quite evident that both the authors thoroughly understand the principle of temperature and time, governing graphitisation to produce black-heart castings of a given composition—which knowledge is only acquired by coming into personal contact with works operations and by carefully making records of results obtained under varying "process" conditions.

The reference to manganese and ratios of manganese and sulphur are particularly interesting in view of experiments made by myself 25 years ago with Admiralty test bars 8 in. × 1 in. × ¾ in. As I write I have before me such a bar, which was practically a black-heart chemical composition before annealing, but after annealing, at ordinary white-heart temperature, has been bent double, *i.e.*, 180 deg., without the slightest signs of fracture, and contains 0.5 per cent. of manganese. Further, it was malleable to the extent of having been forged. There is not the slightest doubt that both Mr. Evans and Mr. Peace will know the reasons for this, and appreciate the result.—Yours, etc.,

E. ADAMSON.

18, York Street, Sheffield.
July 14, 1928.

Nickel-Bearing Pig-Iron.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—Considerable interest is at present being taken in the effect of nickel in cast iron, and very interesting articles have appeared from time to time by such authorities as Dr. Everest and Mr. T. Henry Turner, M.Sc. As far as the British foundry trade is concerned, the use of nickel has not yet progressed beyond the experimental stage, but we believe the reports to hand are very favourable, and, therefore, it seems safe to say that this alloy will shortly play an important part in cast iron. Therefore, in accordance with our policy, we have now placed on the market a special grade of "Lowcar," containing any desired percentage of nickel. As far as we know, this is the first time a pig-iron already known has been marketed with a percentage of this alloy.—Yours, etc.,

For BESSLER, WAECHTER & Co., LIMITED,
A. STULCKEN, Director.

Salisbury House,
Finsbury Circus,
London, E.C.2.
July 11, 1928.

THE SOUTH AFRICAN RAILWAY BOARD has placed an order with the Vickers & Metropolitan Carriage (South Africa), Limited, for 500 steel wagons, at an approximate cost of £100,000.

MESSRS. SIR W. G. ARMSTRONG, WHITWORTH & COMPANY, LIMITED, have secured a contract for three twin-screw Diesel-engined cargo vessels, each of 8,500 tons, for Messrs. Westfal-larsen & Company, of Bergen.

Making Cast-Iron in the Electric Furnace.

The United States Bureau of Mines has completed a comprehensive investigation of the making of electric-furnace cast-iron at its North-west Experiment Station, Seattle, Washington, in co-operation with the College of Mines of the University of Washington. The investigation involved a year's successful operation of a jobbing foundry making miscellaneous grey-iron castings from steel scrap.

The ability of the electric furnace, and not of the cupola, to refine and superheat iron, and the superiority in many ways of electric-furnace iron to cupola iron, make the electric furnace advantageous under special conditions. In addition, the possibility of producing cast iron from cheap grades of ferrous scrap has brought the electric furnace into prominence. Messrs. C. E. Williams and C. E. Sims (authors of Technical Paper 418, just issued by the U.S. Bureau of Mines) state that cast-iron scrap of high sulphur content can be converted into high-grade cast iron, low in sulphur, either by melting directly in the electric furnace or by refining molten metal from the cupola. Large additions of steel scrap may be used if desirable, or steel scrap can be used entirely and synthetic cast iron made. Some of the advantages of the production of synthetic cast iron are outlined as follows:—

One electric furnace can be used to produce both iron and steel, and can thereby be kept in operation during periods when it might otherwise be idle. By operating an electric furnace continuously labour is kept usefully employed, the heat of the furnace is conserved, life of the refractories is extended, overhead charges are reduced, and a high load factor on the power lines is maintained. Therefore, even under conditions where production of synthetic iron would not of itself be economical, it might be profitable in conjunction with the making of steel, because of the possibility of reducing the cost of producing steel.

A large variety of steel and iron scrap can be used to make the same product, and many different products can be made from the same materials. The production of synthetic iron in a steel foundry simplifies the purchase of steel melting scrap. For instance, the making of acid steel requires selected scrap, for which a higher price must be paid than for general scrap; but if, in addition to steel, synthetic iron is made, miscellaneous steel scrap may be purchased at a minimum price and the foundryman can do his own sorting, using the best scrap for acid steel.

In the electric furnace a superior iron, having about twice the strength of ordinary cupola iron, can be made. Transverse strengths of 5,000 to 6,000 lbs. on standard bars of synthetic grey iron have been repeatedly obtained, and tensile strengths above 40,000 lbs. per sq. in. are common. One of the outstanding characteristics of electric-furnace grey iron is its resistance to impact of shock. These advantages in strength and toughness are due largely to the physical structure of the iron, which is fine-grained and dense. The graphite exists in such small flakes that a piece of synthetic iron of the same graphitic carbon content as a piece of cupola iron will appear to contain less graphite. Although it looks whiter and harder than cupola iron, synthetic iron is soft and easily machined. A coarse-grained synthetic iron can be obtained only when the carbon and the silicon contents are exceptionally high. Ordinary synthetic iron is at least equivalent in strength to the so-called high-test irons and semi-steels of the cupola.

The production of synthetic cast iron in the electric furnace is advantageous in such places as large non-ferrous smelters and mills, where pig-iron is expensive and ferrous scrap is usually available. Many ore-concentration plants consume a large tonnage of steel and iron balls and ball-mill liners for fine grinding, and satisfactory white cast iron for these purposes could be made economically at the plant.

THE CUBAN MARKET for cast-iron pipe has been invaded by the cement pipe, Italian manufacturers having, it is reported, secured contracts for this type.

Random Shots.

Some interesting remarks were made not long ago by Sir Frank Heath, until recently Secretary to the Department of Scientific and Industrial Research. Speaking as the guest of the evening at the dinner of the Association of Engineers-in-Charge, he hinted that he was now free to speak his mind on various points. He then went on to say that he considered the Cast Iron Research Association to be one of two research associations which have so far justified their existence in a peculiarly important way—namely, by having introduced definite economies in production.

* * *

Once again MARKSMAN has shown that he is possessed of no mean gift of prophecy. Writing of the I.B.F. Convention not long ago, he found that he had referred to the City and Lord Mayor of Leicester. The phrase struck him as just a little doubtful, and he ascertained—fortunately in time to prevent the "gaffe" appearing in print—that Leicester's chief magistrate was still only a plain Mayor. (No personal application intended, of course!) Now we are informed that Leicester is one of four cities newly raised to the dignity of a Lord Mayoralty, the others being Nottingham, Portsmouth, and Stoke-on-Trent, MARKSMAN hastens therefore to offer his congratulations on an honour that he was perspicacious enough to anticipate!

* * *

And incidentally, if Leicester owes no small part of its importance to boots (very much in the plural) the importance of Nottingham may be said to depend, in part at least, upon one Boot (very much in the singular!)

* * *

I have just been looking at the imposing Directory published by A.S.L.I.B. (in other words the Association of Special Libraries and Information Bureaux—what a mouthful? You can see why they stick to initials!) The volume might be described as useful rather than ornamental, but among the topics to which it is supposed to serve as a kind of glorified sign-post there are some of considerable interest. Glancing at the heading, "Pig-Iron," for instance, my eye was caught by such ill-assorted neighbours as "Pigeons," "Plainsong," "Pianola," and "Pimlico."

* * *

"To see ourselves as others see us" appears to be one of the most consuming of human passions, and it is no doubt this fact that has prompted a recent move on the part of a London evening paper. It has announced that Mr. Sinclair Lewis, the American author, will write for its pages a series of articles on English life, showing up our vices and our foibles in much the same way as his well-known books show up the vices and foibles of small-town America. Well, no doubt there are just as many unpleasant features in English life for those who know where to look for them—but the question is, will the author of "Main Street" and "Babbitt" be able to do just that? It is Mr. Lewis' very American-ness—if the word be permitted—that enables him to write as he does, and the most he can give us will be an interesting picture of England as it strikes an American.

* * *

An experiment with a not dissimilar object was actually carried out by the broadcasting authorities during the past winter. Various distinguished foreigners visiting England were invited to tell the microphone what they thought of us. But as they—very wisely—tackled the problem in a light-hearted and bantering spirit, we were not really much the wiser as to what foreigners really think of us.

* * *

SCIENCE IN THE HOME.

Maid (to mistress returning home): Oh, please, ma'am, I don't 'ardly like to tell you! I've bin an' mixed up the terminuses, an' the wireless is all a-covered with icicles an' the refrigerator's a-playin' "Land of 'ope and Glory!"

MARKSMAN.

The New Penpoll Tin Smelter.

Last Friday the Earl of Derby started the furnaces of the new Penpoll tin smelter at Bootle, near Liverpool. From now on the smelter will never cease work day or night. The Penpoll is claimed to be the biggest and most up-to-date British-owned tin smelter in Europe. It has been built principally to deal with the increasing output of British Empire ore. It is contended by the owners that the new plant will be a means of not only speeding up the smelting of existing supplies of ore, but of bringing larger quantities of tin ore to this country to be smelted. It has the largest tin ore stores in the world capable of holding five hundred thousands pounds worth of tin ore. The latest reduction methods have been introduced. There is an auxiliary plant for reclaiming metal from the waste gases of the smelter, which increases the output of the smelter by 2 per cent., equal to a saving of two hundred tons per annum. This is a great advance on the old process when large quantities of tin were lost through this means. The process is effected by means of an electrostatic high-tension discharge of one hundred thousand volts.

Before the new smelter was begun, models of all the various sections were constructed to test the best way of arranging the plants so that when the smelter was finally erected it should give the maximum output and most efficient production. On its arrival tin is taken to the roasting and leaching plants to have its impurities removed. It is first subjected to a heat of 600-700 deg. C. in the roasting plant. Then it is passed through the leaching vats.

Twenty-five tons of ore are now continuously undergoing this treatment. British Empire ore is sufficiently pure to allow the roasting and leaching processes to be omitted, and this means an immense saving in comparison with the treatment of foreign ore, and enables the smelting to be done more quickly. The ore roasted and purified is now ready for the main furnaces. It is prepared in a series of charges hoisted electrically, and loaded on to an overhead runway into the hoppers over the main furnaces. The ore is shot from the hoppers into the furnace and subjected to a heat of 1,230 deg. C. Fah. The ore makes a continuous circle of progression and purification until at the end of its journey it emerges in ingots of pure tin. As a rule, the metal is sold before it is cold. The Penpoll Works will be devoted largely to the smelting of Nigerian ore. The history of the industry in that corner of the Empire is one of the romances of the century. The first sample was brought home in 1889. In 1905 the output was ten tons. Last year it was over eleven thousand tons.

There have been many trips organised to visit the opening of Works, but on no occasion has the details for the comfort of the guests been so carefully or efficiently studied. It would seem that the railway company entered into the spirit of the proceedings. The train itself had every appearance of being brand-new. A colour scheme had been devised for each compartment, with flowers to synchronise with the scheme of things. At each end of the train was a completely equipped picture theatre, comfortably and delightfully furnished, and there is little doubt that pictures under these conditions made pleasant what otherwise would have been a rather tedious journey on a very hot day.

On arrival at Bootle, the thought and care that had been expended on the journey proper was by no means concluded. A portion of the Works had been converted into a glorious dining room, where a meal that would do credit to the Savoy or Carlton was served, followed by delightful speeches delivered by Lord Derby and the Chairman.

There was a distinguished company at the opening ceremony, including Lord Askwith, Major C. R. Attlee, M.P., Mr. John Baker, M.P., Professor G. O. Bannister, Mr. R. Dennison, M.P., Lord Derby, Mr. John Fry, J.P., Mr. Edmund Howeson, Mr. J. C. H. E. Howeson, Sir Edgar R. Jones, Mr. Barring Hooper (managing director, FOUNDRY TRADE JOURNAL), Mr. Frank Lazarus, Mr. Leopold Lazarus, Mr. W. R. Long (FOUNDRY TRADE JOURNAL), Mr. Arthur Pugh, Dr. Walter Rosenhain, F.R.S. (President, Institute of Metals), Mr. G. Shaw Scott (Secretary, Institute of Metals), and Mr. H. Spence Thomas.

MR. JOHN HOWESON, chairman of the New Penpoll Empire Tin Smelter, presided at a luncheon, which followed the inspection of the works.

He claimed that tin was coming in a very practical way to the aid of British agriculture. In many parts of the country canning was already relieving the mental as well as the financial depression of the farmer. There were, indeed, almost boundless possibilities for fruit-canning, vegetable canning and fish canning in this country. It appeared to be incongruous that their country which controlled some 80 per cent. of the world's output of metallic tin should still depend on the foreigner for most of her tinned food supplies. He explained that at the present time they could smelt at the works one thousand tons of tin ore per month, but they were readily capable of enlargement and expansion to handle up to six times that quantity. When enlarged to its full size and capacity the smelter would, if necessary, be able to cope with more than one-third of the total tin ore supply of the entire world. For the first time in the history of tin a vast quantity of Empire tin ore could be smelted on British soil under entirely British control.

MR. HOWESON asked how many people apprehended that without tin much of the fabric of modern civilisation would be entirely impossible of realisation. Tin was a requisite for all high speed machinery, upon which in turn the mechanised existence of to-day was primarily founded. It was only by the tireless efforts of the tin-producing industry that this demand could be met. It was not too much to say that upon the enterprise of tin producers and smelters depended in no small measure the future prosperity of the British Empire, and even that might be the survival of the present civilisation.

LORD DERBY congratulated them on being the largest of British tin smelters built for dealing with Imperial tin. He appreciated—and in this respect believed he spoke for the man in the street—those who started work in this country, which would be of equal benefit to ourselves and the Dominions from which the produce came. The more they could link the two together the better it would be for all of them. (Cheers.) It was the Dominions in which they would find additional markets for their goods. Lord Derby congratulated them upon the courage they had displayed, and observed that, generally speaking, there was not sufficient courage in looking ahead.

Mr. Howeson presented to Lord Derby a gold cigarette case, engraved with the Derby coat of arms in tin.

The Romance of Metal.

By H. LITTLEHALES.

When metal comes under the hands of the craftsman the finished article at times experiences the most romantic adventures. What could be more romantic than the astonishing adventures of the great eagle lectern of Newstead Abbey? Before the arrival of Henry VIII's commissioners sent to seize the property of the abbey the monks unscrewed the ball of the lectern, and putting into it the title deeds of their property, screwed the ball up again, and threw the lectern into the monastic fishpond. At the bottom of this pond it rested until in modern times it was found, and after a thorough cleansing sent to Southwell Cathedral, where to-day it serves once again its original purpose.

Or again, the story of the magnificent censer and incense boat of Ramsey Abbey, which under similar circumstances was sunk by the monks in the depths of Whittlesey Mere, where for centuries both censer and incense boat rested till in modern times the mere was drained and the vessels found and presented to the Victoria and Albert Museum, where in a very special case these beautiful pieces of metal work rest to-day.

Such adventures, and those of many other pieces of metal work which also have curious histories, make us wonder what their makers would have thought could they have foreseen what was to happen to the results of their craftsmanship. Let us give five further examples of the curious experiences of worked metal.

St. Oswald Processional Cross.

Very few of the numberless fine metal processional crosses once in every church in this country remain to-day. At St. Oswald's Church, in Durham is, however, one which can claim to have had a curious adventure. We do not know to what church this cross originally belonged, nor when or by whom it was taken from its original home. The adventure of this cross lies in the strange place in which it was found. It was discovered in, of all places, the "boot" of one of the old mail coaches! We must suppose the cross to have rested somewhere for long before it came to be deposited in the old coach boot, but where it went at the time of the Reformation and how it got into the boot we are unable to even guess.

The Eagle Lectern of Bovey Tracey Church.

Dr. Hyde, for many years rector of the church of Bovey Tracey in Devonshire, once furnished to the writer the strange story of the lectern. He states that local tradition insists that the lectern, still in daily use in Bovey Tracey, was buried during the incumbency of the Rev. James Forbes in the churchyard or in a pond in the parish, to protect it from the Cromwellian soldiers. In letters relating to the Vale of Teign by Dr. Fraser Halle and Dr. Croker of Bovey Tracey, London, 1851, it is said that the lectern was, during the stay of the parliamentarians, buried in a ditch until the Restoration of Charles II. Dr. Hyde is of opinion that such was the case and that the "ditch" was just over the churchyard wall to the south behind the Church House, perhaps under the rubbish heap of the "Church House Kitchen."

The Leyland Chalice.

This beautiful little cup has passed beyond the confines of the church for which it was made. The odd part of the adventure of this fine piece of metal work is that, made for the Parish Church of Leyland, in Lancashire, it, after various adventures, has returned again to its old locality. But it is no longer the chalice of the parish church; to-day it serves in the chapel of the Roman Catholics. The cup bears inscribed on its foot the words "Ristore me to Leyland in Lankeshire." It is a satisfaction to realise that if not restored to its old habitat, it rests within some hundred yards of it.

The Tazza Cup of St. Michael's, Southampton.

The Tazza of St. Michael's Church, in Southampton, is probably one of the finest pieces of metal work of its kind of about the time of the Reformation. The cup is of a handsome shape, but was never made to be a chalice, but was fashioned for use at some rich man's table. It was made in the early days of the reign of Elizabeth, and its weight is over a pound. Where this vessel came from is not known, but we may very reasonably believe it to have been present at some very animated, if not hilarious scenes of dinner-table festivities. Though we do not know the donor of the cup, we do know that of another in a neighbouring church, and the very odd nomenclature may perhaps excuse the mention of his name; it was Bridecake!

The Chrismatory of St. Martin's Church.

In the little church of St. Martin, near Canterbury, is a pretty little metal box some hundreds of years old. This little box was made to contain the chrism and other oils used in the service of the church. At the Reformation the box vanished, to reappear some three hundred years later, when it was found (evidently purposely hidden) on the top of the nave wall of the church. For all these years the unsuspecting worshippers had had the little box close to them, uncovered.

OWING TO THE need for immediate expansion, which is not easily possible on the site of their present premises, Messrs. Robert Hyde & Son, Limited, iron and steel founders, of Abbeydale Foundry, Sheffield, and of Chesterfield, are moving the Sheffield part of their business to Stoke-on-Trent. They have purchased at Stoke a large section of the North Stafford Locomotive Works, which were vacated when the railway grouping scheme came into operation. The new works will be called the North Stafford Steel Works. The transfer will commence in about a month's time. It will be gradual, and the Sheffield works will be kept going until the new premises are in production.

Methods of Running and Rising Repetition Castings in Steel-Mix Cast Irons.

By Arthur Smith, M.A.

Recognised or acknowledged methods of running, rising and feeding castings, vary greatly not only with different classes, but also with the same class of work in different foundries or foundry districts. Consequently the author wishes clearly to state that his methods apply chiefly to certain types of repetition castings produced entirely from moulding machines and poured in steel-mix cast irons. The real necessity for expending a great deal of time and thought on deciding the size, shape, and distribution of runners and risers becomes most apparent when one has to deal with high-class castings for pressure work, castings which are small but "lumpy" and have to be machined on all faces, as well as all castings which in the ordinary course of events would be rod-fed either on or off the casting. By rod-feeding off the casting is meant that method whereby feeding by rods takes place in the runners, risers or feeding heads, where present, without the feeding-rod entering any part of the casting proper. In most repetition shops where the majority of the work is made on moulding machines, the pouring as well as any rod-feeding which may be considered necessary has to be carried out by semi-skilled machine moulders helped by labourers.

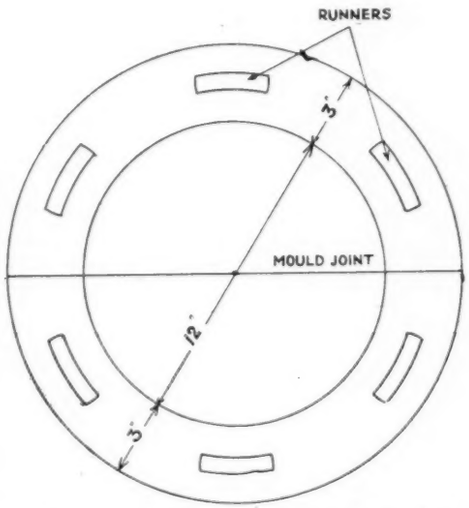


FIG. 1 (*a*).—PLAN OF CASTING SHOWING SIX SMALL RUNNERS ON TOP.

Rod-Feeding.

Rod-feeding when carried out by a skilled moulder may give excellent results in the case of "lumpy" castings which do not have to retain gases or liquids under high pressure, but when applied to large daily quantities of repetition work of the same class it is a decided failure. Also in the cases of high-class castings to withstand high pressures rod-feeding is practically useless, no matter how skilfully it is carried out.

In modern foundry practice, where steel-mix irons, produced by adding 25 per cent. and upwards of steel scrap to the cupola charge, are used, attempts at rod-feeding are often disastrous, the higher freezing point of such moderately-low total-carbon irons probably contributing largely to such failures.

Running Cylindrical Castings.

With many classes of castings, such as castings of a cylindrical shape comprising well-known types like compressor liners, compressor bodies, Diesel liners, compressor and Diesel pistons, hydraulic and steam cylinder bodies, etc., the question of running is not quite so important, as provided the shape and size of the feeding head is correct, or at least not less than certain readily defined minimum proportions, the size, shape and distribution of the runners is, within moderately wide limits, a secondary consideration. However, in practice, it will usually be found that the height of the feeding head can be reduced when such castings are poured with small runners distributed round the top (see Fig. 1 (*a*)), but this is often not a practical proposition when liners, etc., are moulded horizontally from split-patterns and turned up to cast, this being especially so where the number of castings to be produced does not allow for the provision of an elaborate and consequently expensive pattern. Again, where jobs have to be cast vertically the holes in any standard sizes of moulding boxes

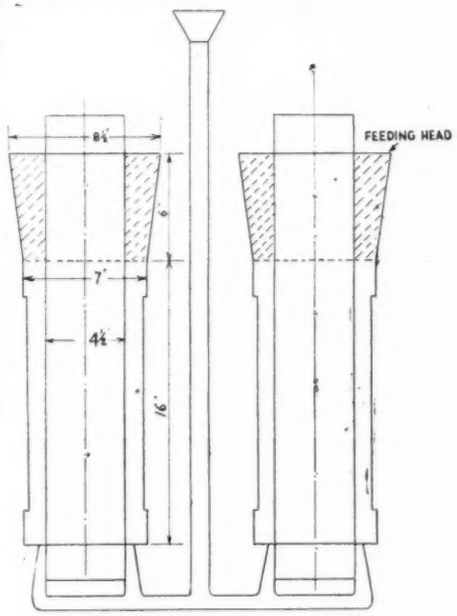


FIG. 1 (*b*).—METHOD OF BOTTOM RUNNING A PAIR OF LINER CASTINGS IN GREEN-SAND MOULD FROM SPLIT PATTERNS. THE GATES MAY BE CUT OR MOULDED IN ONE OR BOTH HALVES AS REQUIRED.

available may not allow for more than one runner and the number off may not justify either the provision of special boxes or the carrying out of alterations to the existing boxes, so that very often either one top or one bottom runner has to be adopted.

Top-Running Advocated.

Although well-distributed top-runners are always the ideal to be aimed at, because by this method the hot metal is supplied at the exact spot where it is required, namely, on the top of the ascending bath of liquid in the partially-filled mould, yet the exigencies of cheap moulding methods do not always allow of this ideal being attained. Thus, in green-sand work cast vertically, bottom runners have for various reasons a distinct advantage, yet in dry-sand work the author emphatically advises the use of top runners, so distributed that all parts of the mould will be filled at the same rate. Fig. 1 (*b*) also shows a method of running liner castings in green-sand to the best advantage, the principle underlying the example being equality of rate of filling the mould.

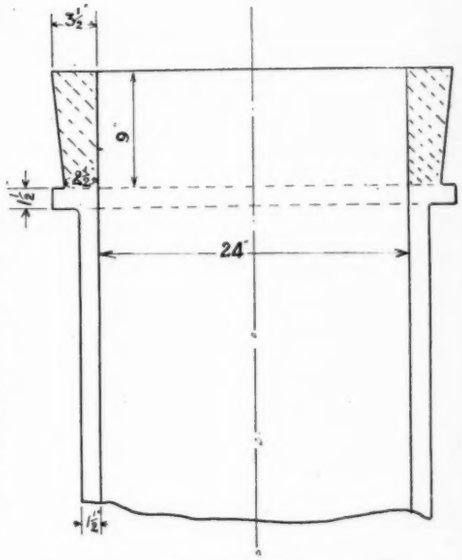


FIG. 2 (*a*) (top).—TAPERED FEEDING HEAD ON FLANGED CYLINDER, 24-IN. BORE. DIAGONAL THICKNESS OF FLANGE 2⅛ IN.

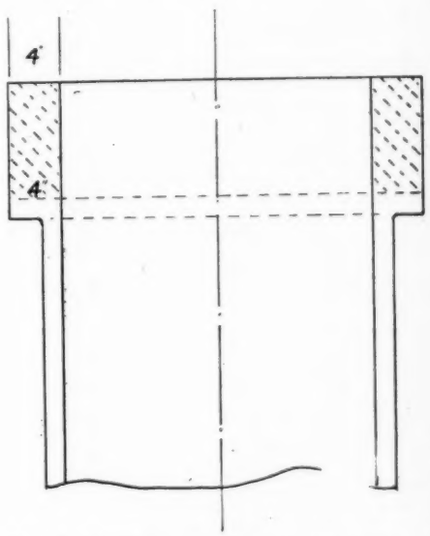


FIG. 2 (*b*).—PARALLEL FEEDING HEAD ON SAME FLANGED CYLINDER.

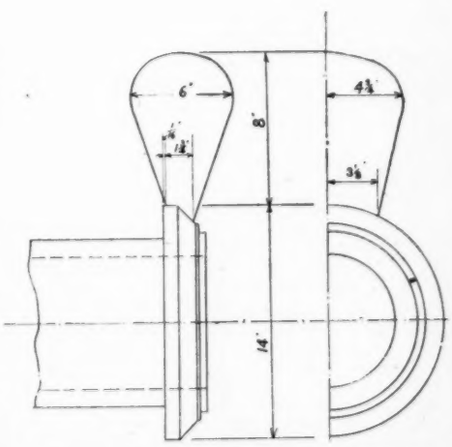
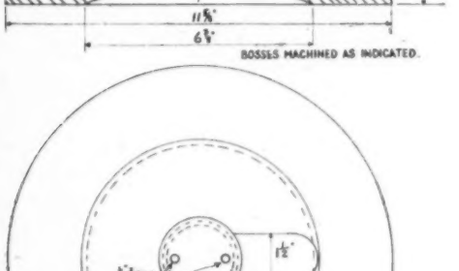


FIG. 2 (*c*).—METHOD OF APPLYING FEEDING HEAD TO CIRCULAR BEVELLED FLANGE ON PIPE OR SIMILAR CASTING WITH HEAVY FLANGE.

There is much divergence of opinion amongst foundrymen as to the best type of feeding head to be used, but where possible the author is strongly in favour of the use of tapered heads of suitable bulk to ensure that the head is the last part of the casting to freeze, and that it has done its work of feeding before it has frozen at the point where it joins the casting proper. Fig. 2 shows types of feeding heads which have been used with success. In the case of flanged cylindrical castings, such as compressor bodies, steam cylinders and the like, it is an excellent rule to make the width of the base of the head at least one quarter of one inch greater than the diagonal thickness through the flange (see Fig. 2). Similar heads can usually be adopted on castings such as compressor cylinder cores or heads, Diesel cylinder heads and the like. Where moulding requirements are such that parallel or nearly parallel heads must be adopted in place of tapered heads, then such heads should cover the whole area of the top flange (see Fig. 2).



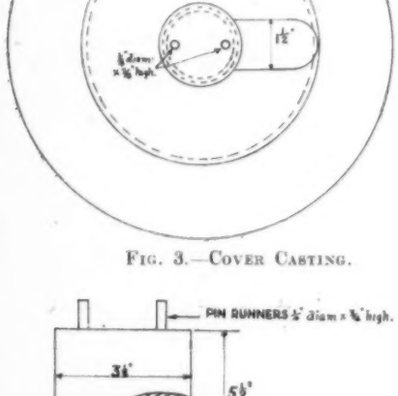
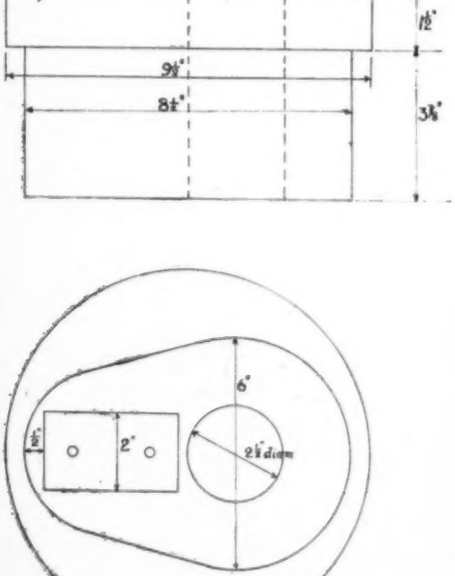


FIG. 3.—COVER CASTING.



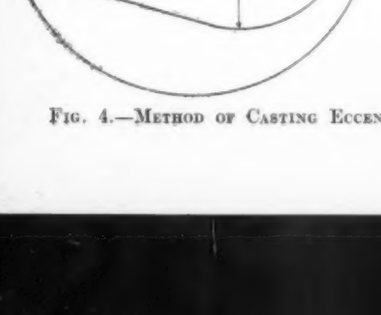
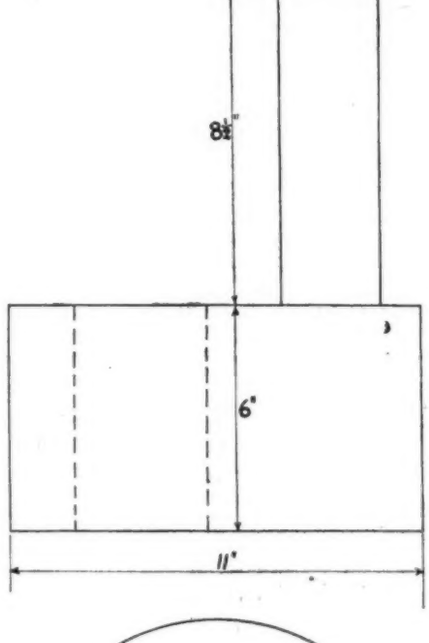


FIG. 4.—METHOD OF CASTING ECCENTRIC.



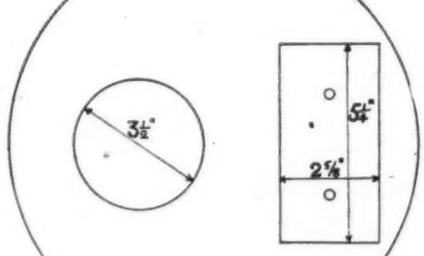
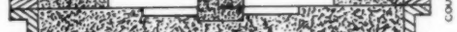


FIG. 5.—ECCENTRIC CASTING.

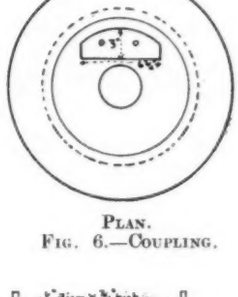
Pressure Castings.

Many pressure castings, however, particularly those of a flat design, such as nearly all varieties of covers for pressure work, including steam cylinder-covers, cannot be tackled in this manner unless it is possible to cast the cover on edge with a wedge feeding head of suitable dimensions.

Heavy flanged or bossed-valves and pipes for high pressures can similarly be dealt with by having blind feeding risers on the parts which require them, and, of course, in nearly all pressure castings other than cylindrical castings or vertical castings, where the section of the castings is definitely uniform throughout, then ordinary methods of running and rising will answer. But a very large percentage of such castings contain parts of widely varying thickness of section, in addition to such adjuncts as heavy flanges, heavy rims, heavy bosses, thick wall junctions, and it is in this class of casting in particular that shrinkage cavities, or at least open-grained, drawn spots will undoubtedly develop unless the ingenuity of the foundryman and the skill of the

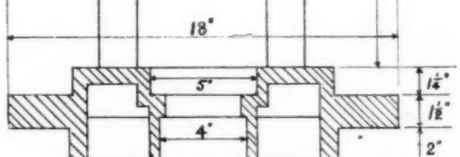


MOULD READY FOR POURING.



PLAN.

FIG. 6.—COUPLING.



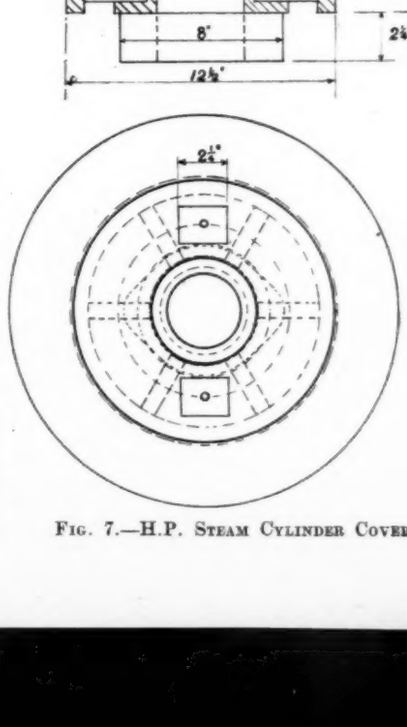


FIG. 7.—H.P. STEAM CYLINDER COVER.

metallurgist are jointly brought to bear on the problem with a view to the provision of reliable remedies

A Difficult Cover Casting.

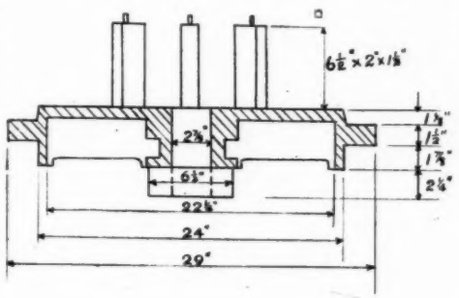
Fig. 3 shows a very simple type of cover casting which has given considerable trouble when treated by the usually recognised orthodox methods of running, such as (1) a single runner at one side of the periphery either entering at right angles or tangentially with the casting with or without a riser or flow-off directly opposite; (2) a runner or spray of runners at one side with a heavy riser over the full section of the boss; (3) a chill or densener placed under the heavy boss and the casting treated otherwise both as in (1) and (2); and (4) the casting inverted, *i.e.*, boss A cast in bottom with and without risers and chills. Various grades of iron mixtures were used varying from highly-phosphoric, high-carbon, medium-silicon irons down through a complete range to moderately-low total-carbon irons with low-phosphorus and comparatively-low silicon with widely divergent but totally unreliable results. In every case a percentage of the castings (higher with some methods or mixtures of metal than with other) leaked under air test either round the base of the bosses A and B through the seating which is machined in boss A or between the rim and the body of the casting. Pencil runners as shown in the sketch (Fig. 3) were tried in conjunction with steel-mix metal which had previously failed with other methods of running, and the result was that batch after batch, as well as various sizes of the same type, could be made perfectly sound each time.

Pencil Runners.

This is a typical simple application of the well-known slow-running principle using "pencil" or "drip" runners. The diameter of the runners should be kept as near to ¼ in. dia. as possible and two or more used according to the size of the job. These runners are inserted in the form of an oil-sand core, about ⅜ in. thick, either into one main feeder or each into an individual feeder depending on the size and contour of the casting. The method is quite simple and in conjunction with steel-mix irons of suitable composition, gives excellent results. It can, with success, be applied to a wide range of castings and where the castings have to be machined all over with an entire absence of even minute flaws, this method results in much cleaner castings from green-sand moulds than is the case with ordinary methods or running. As will be seen from the various diagrammatic illustrations, the drip-runners run directly into a sort of feeding header and no riser or flow off of any kind is necessary except the provision of "poppers" in the case of large circular castings of comparatively thin section. In pressure castings this method of running will in many cases obviate the use of chills or denseners. Denseners when used in green-sand moulds require very careful preparation and are very liable to collect condensed moisture on their surfaces with resultant blown castings. For this very reason, many repetition machine-moulded jobs where denseners are used have to be made in dry sand, but with a suitable combination of feeding stick and drip or pencil-runners, green-sand moulds can be used without fear of failure.

"Lumpy" Castings.

Apart from castings for pressure work the method is used for the production of so called "lumpy" castings, such as couplings, eccentric sheaves, gear blanks, solid piston heads, and similar castings which usually have to be bored out in the heaviest part of the casting. In a machine-moulding shop, if one put on the floor a considerable number of moulds for couplings and similar castings to be poured from the same or consecutive crane ladles and the castings have to be fed, the shop labour and routine is greatly disorganised with a man feeding each casting and the results obtained are often far from satisfactory. Figs. 4, 5 and 6 show such castings which if run in the ordinary way must be rod-fed either on or off the casting. The same thing applies to rope wheels, disc-type flywheels and similar castings where it is often necessary to rod-feed the centre boss. See Figs. 7, 8 and 9. The use of two, three or four drip runners coupled with a cheap moderately high-silicon steel-mix iron will render such feeding unnecessary. In



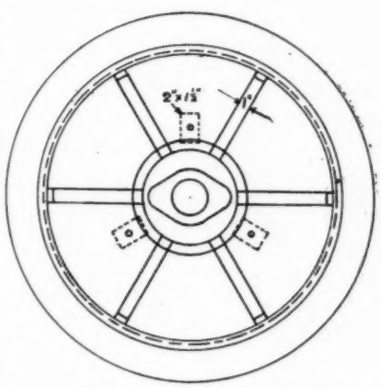
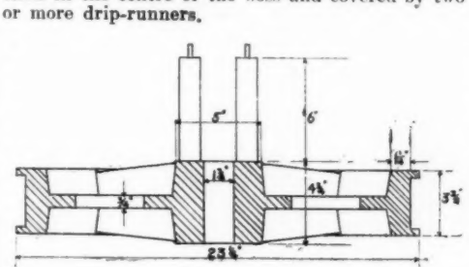


FIG. 8.—L.P. CYLINDER COVER.

some cases it will be found advantageous to leave out the centre core, especially if it is small in diameter, and place a moderately-large feeding-stick in the centre of the boss and covered by two or more drip-runners.



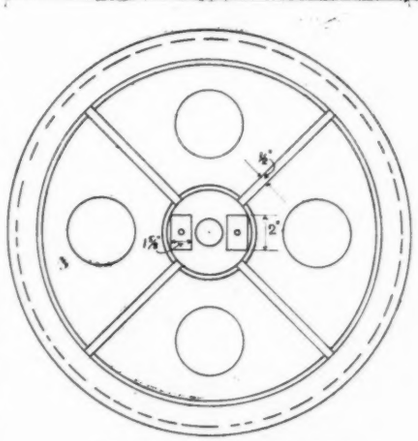


FIG. 9.—22-IN. LEAD WHEEL.

Mixtures Recommended.

Suitable metal for such jobs will be found to be readily provided by mixtures containing 15 to 25 per cent. low-phosphorus pig-iron, 25 to 50 per cent. heavy steel scrap, 5 to 10 per cent. high-silicon hematite and the remainder good-class machinery-scrap iron, part of which will usually be substituted by surplus melt iron (*i.e.*, runners, etc.) of the same grade. Ferro-manganese will be added in massive form to the cupola charge as required to give the manganese content aimed at. The amount of high-silicon iron to be added will depend on the final silicon-content required and the percentage of steel in the mixture. The final composition should be within the following limits:—Total carbon, 3.1 to 3.3 per cent.; phosphorus, not over 0.5 per cent.; sulphur, for all but light castings this figure is unimportant up to 0.15 per cent.; manganese, 0.7 to 1.0 per cent.; and silicon, 1.3 to 2.0 per cent., depending entirely on the bulk and section of the castings being poured.

Hot Metal Essential.

The metal must be hot from the cupola, not less than 1,400 deg. C., if possible, and it must be handled and distributed quickly so as to reach the pouring basin of each mould at a temperature sufficiently high to allow of free running. Where a row of moulds has to be poured from the same ladle, the best method is to make the pouring basin sufficiently large to take a little more metal than is required to make the job. Fill the basin as rapidly as possible from the ladle and immediately go on to the next mould. By the adoption of this system much valuable time is saved in dealing with pencil runner moulds and with practice on standard jobs it soon becomes easy to gauge the correct size of the pouring basin, allowing for the metal which enters the mould as the basin is filling.

Although nothing new is claimed for the method yet the systematic application of the combination of pencil or drip runners with heavy feeding sticks and suitable steel mix metal has been found very valuable in dealing with the repetition production of castings of the types indicated. Pencil-runners without the additional combination had previously been tried but had to be abandoned on account of the tendency of the top-side of the lumpy castings to sink. The use of feeding-sticks of the proportions indicated have been found to eliminate this trouble and these feeders can be readily removed in the foundry by nicking round with a pneumatic chisel and subsequent removal by a sharp blow. Many pressure-castings cannot carry a feeding-head of the usually recognised type and for such castings a wide range of utility seems to be open to the method outlined above. In conclusion the author would like to add that as in all other production methods for the manufacture of high-grade iron castings, complete success can only be achieved when there is loyal co-operation between the foundry manager and the metallurgist.

Continental Steel Trust.

M. A. Meyer, the successor of the late M. Mayrisch in the management of the Arbed concern in Luxemburg, has been elected President of the Continental Steel Trust.

According to a later report, the Central European group of the Trust has been dissolved, and the president, Dr. Sonnenschein, has laid down his office. The Austrian, Czecho-Slovak, and Hungarian works each form now an independent national group, but all remain in the Trust.

The next meeting of the Trust will be held at Luxemburg on September 14, when the production quota for the final quarter must be fixed.

The internal reorganisation now proceeding within the Trust as a result of the dissolution of the Central European group is going to give Germany a commanding position. It may be recalled that the German United Steel Works already control the share majority of the Austrian Alpine Montan Company. Under the statutes of the Trust a minority representing 25 per cent. of the quota votes can veto decisions on many points, while the carrying through of other decisions requires a three-quarter quota majority. The veto right cannot be exercised if it is in the hands of one country. Germany possesses a 43 per cent. quota, and, with Austrian support, will hold a controlling position in the Trust.

MESSRS. SWAN, HUNTER AND WIGHAM RICHARDSON, LIMITED, have secured an order for two vessels for foreign owners.

Foundry Costing.*

National Foundry Gathering Exposes Common Fallacies.

MR. WINTLE said, in presenting his Paper on Foundry Costing, that it was particularly gratifying to him, as a member of a kindred Institute, to have that opportunity of exchanging views with the members of another Institute. If one could criticise institutes at all, it was generally in the fact of their insularity and aloofness. To his way of thinking, progress of the right order would surely be achieved in all Institutes by the free exchange of these real and vital issues for which they existed. Therefore, he welcomed that occasion, both personally and on behalf of the Institute of Cost and Works Accountants, as indicative of the interest which was being aroused all over the country in costing as it related to manufacture. As far as possible, he had endeavoured to keep out of the paper the purely cost accounting side, realising the need of the man in the shop as being greater, and to whom the clerical side had no interest or attachment except in so far as it related to the methods employed in getting out the costs.

Before any appreciable progress was made on either side, there would have to be not only mutual, but reciprocal advances, so that on the one hand no accounting principles were violated, and on the other hand the peculiar difficulties of the shop were perfectly understood. The outline of the system presented was not laid down in any way as purporting to represent the only way; but as an indication of the more modern methods which should govern not only our costs but our quotations. The idea was to lead away, or rather out of, the old rut of recognised past habits into the newer and less beaten tracks.

Cupola Costs.

Referring to Summary Cost, and particularly as regards the cupola, one might be safe in assuming that apart from wages of cupola tenders and labour handling materials, plus coke and limestone, not much else had entered into the reckoning when pricing out an estimate, or making up a cost. He was referring to the general run of foundries; but he was aware that there were quite a number which had installed modern methods of costing, and which went into quite elaborate analyses for all purposes. When, however, one considered the cupola cost in its entirety, it was readily seen what a number of other expenses were applicable; such as the burden of its own repairs and upkeep, its depreciation, the proportion of power generated for hoist, blowers, etc., lighting, laboratory, workmen's compensation, rates, insurances and sundry consumable materials.

What was the factor governing cupola cost? The weight of material which was represented by the castings produced. It was surely imperative then, when talking of "cupola cost," that it should be an all inclusive cost; and every casting made should bear its due proportion according to its own weight. How important this became was the more readily seen by contrasting two different types of work. All foundries had encountered heavy, solid castings which called for very little skill in moulding, and not much in time and wages, whilst others met with were very intricate, fragile, "full of cores," that is castings weighing very little for their size, but costing an extraordinary amount in time and wages, where the moulder dared not trust himself to piecework, but had to feel his way, generally with the help of a pattern-maker. There they had a typical case of two extremes. They would see quite plainly that if the cupola cost was whittled down to anything below its true reflected cost, taking in all the factors known to be applicable, then those items of cost which had been omitted would surely have to be borne by the intricate casting, the heavy casting escaping; because it was general practice, after the cupola cost had been dealt with, to spread all other overhead expenses in proportion to wages incurred direct. It should therefore be a first consideration for the weight to stand its proper cost. Incidentally, it would appear that firms who made heavy castings amongst others, and costed their cupola at anything less than the true cost, were selling these castings too cheaply and were not recovering the cost of production. On the contrary, those firms who specialised in intricate work amongst other castings, would appear to be burdening these same castings with more than their share of expense, because the heavier ones had escaped.

Moulding and Core Shop Costs.

It had been said with much force that figures could be made to talk whichever way was wanted. That was quite true. What was needed, however, in every industry was the basis agreed upon by works and offices as to the correct accounting principles to be employed, and then to stand faithfully by those principles in good times and in adverse times, letting the tabulated result govern the policy of the department, never seeking to find explanations through any other way than what the costs of production indicated.

MR. W. R. WINTLE, F.C.W.A.

Mr. Wintle, who presented a paper on "Iron Foundry Costing," is head of the cost department of Messrs. Sheepbridge Iron and Coal Company, Limited.

Items 3 and 4 of the Summary Cost related to the "Moulding and Core Shops." There the wages were shown subdivided under four headings, dealing with dry, green, loam and machine moulding. That might or might not be important in the Summary Cost, but it became more so when dealing with individual or job costs. The idea shown there could be extended to showing in the Summary Cost the approximate cost per ton of each of the four groups side by side, that depending to a large extent upon what facilities any particular foundry had for supplying the necessary details of loam, dry-sand, green-sand and machine-moulding work. Carefulness was essential both in analysing wages for moulders and helpers, but more particularly in the case of the labourers and repair workers. The making up of the schedules referred to depended on these analyses, and the apportionments to the various shops would be reflected in the items shown as "Percentage of overhead expense to direct wages," and also that under "Indirect Labour."

Summary Cost Sheet Grouping.

A careful study of the summary cost sheet would make quite clear the intention of that grouping. For instance, the direct wages in the moulding shop were the wages of the first four items. The overhead expenses would be as follows:—Repairs, suspense account, depreciation, power, light, heat, rates, workmen's compensation, etc. The indirect wages of labourers was principally concerned with metal, and should be added on a weight or cost per ton basis. Therefore, one got overhead expenses × 100 direct wage to give the percentage needed. To that was added general expense (item 7), which percentage was arrived at by taking all the direct wages of the moulding shop, core shop, smith's shop and fettling shed, and dividing into the total of general expense— × 100. Assuming the moulding shop worked out at 40 per cent., and the general expenses at 25 per cent., one obtained 65 per cent. as a total. The core shop might work out at, say, 30 per cent., and the general expense at 25 per cent. Then one had 55 per cent. as a total. The smith's shop might work out at 70 per cent. and 25 per cent., a total of 95 per cent. It was then possible to quote for, or cost, cored and uncored castings and give them their proper quota of establishment charges. The smith's shop might only be needed in costs or quotations occasionally, where, say, eye-bolts were made and cast or fitted, or where special tackle was made for a loam-built job. In these circumstances, also, the extra charge could be added. For many years, he had heard drilled into responsible officials the necessity and importance of regulating the fettling shop by keeping it as empty as possible, which sounded somewhat paradoxical, but, nevertheless, it was an unwritten law that for this department to become congested was the sure indication of bad management. The result of such congestion was always without exception seen in delivery complaints. All that was reflected in the cost per ton of fettling. Referring to item 5, they would see wages, fettling, labour in or about the shop, repairs, suspense account, depreciation, power, light, heat, etc., and sundry stores. The wages of fettling divided into the remainder of the expense, × 100, would give them the expense to be added for overheads. He thought costing in the fettling shops should be as direct as possible, that is to say, where intricate work was involved, time should be charged up as incurred, the rest of the general work to be graded so as to give, say, three prices per ton, according to a schedule of weight. That method formed the basis of payment by results to the fettlers, and definitely fixed the cost per ton apart from overhead. It was up to the charge-hand then to keep his shop empty. If he applied for more help it cost no more except in insurance, etc. He knew of firms where time at ordinary rates of wages was set against tons at so much a ton; and if the fettling shed was empty they paid the difference, if not they withheld payment, or carried forward the loss. Obviously the fact emerged that if at the end of a month's trading the castings made, representing, say, 300 tons, were divided into the cost of fettling for the month, the cost per ton would only be true if all the castings had been fettled. He was very much afraid that in many foundries that was hardly the case.

Foundry Design Can Help Costing.

An admirable costing ensued from a carefully planned foundry built in separate bays, and equipped with the correct class of plant and tackle for making different types of castings. If the bays had clearly defined borders, each busy making a different product, then the same rules of procedure could be applied as indicated in the cost sheet, excepting that three cost sheets would be prepared, one for each bay. The types of castings of a small nature, man-handled, etc., would be in one bay; those requiring jib cranes and runways would be in another; and the heavy castings requiring overhead cranes, etc., would be in a third. The cost would be worked out for each bay, and a summary cost of all three made. The jobs made under these conditions would very naturally bear only the burden expended by their particular bay. It had not been possible to show the cost sheet in general the opposite side to form 1; but on that side was gathered a summary of each week's wage bill, the details of the various charges making up the running expenses, such as electric power consumed, gas used, charges for wagon hire, pattern carry-

* "Iron Foundry Costing," by W. R. Wintle, which has appeared in our recent issues.

ing, carriage on sundries inwards, charges from other departments, water charges, stores issued in oils, grease and waste, and many other items, which were all necessary in managing a foundry. The aim of the make-up of a cost summary should be simplicity. Everyone who assisted in the management of a foundry should know how to read it. Everyone there knew how keen buyers were. They took every advantage of the man who made a mistake in quoting, not always by penalising him so much by giving him the order; they were more subtle than that: they held his quotation over the heads of the people *they* wanted to make the castings. Another aspect of that always impressed him when doing a fair amount of estimating himself. A low tender not accepted and the error never discovered led to the assumption, when the same or a similar inquiry came again, that the previous price was too high. Hence the endeavour to quote lower still with a consequent deflated market and everybody suffering, from the workman upwards. It was only natural when work was scarce for the better-placed firms to snatch at anything at any price to keep doors open; but the fact was mainly there that it was primarily due to poor costing or estimating and not to economic conditions entirely, that selling prices reached such low levels. Again, how often did foundries get the wrong type of work through the same cause, with the right foundries wondering where the work had gone. And no one knew the ultimate losses in buying such experience. Therefore, he pleaded for good costing in the first place, and the sending out of estimates that were based on the true cost.

Extra Work Involved.

Particularly would he like to draw attention to the need in engineering works, where a foundry was considered as part of the whole, for a departmental system of costing, as well as a system of job costing. He knew from experience that many regarded the extra work involved from a clerical point of view as a big obstacle, but the fact remained that they did not know whether the foundry paid or not. The fact that a product was on the market at a remunerative price to the whole works did not necessarily mean that the foundry had produced it at the lowest cost. The profit might be all in the machine shop. Many firms believed in a bonus system for foundry officials based on output and cost. With a department cost in force, the best basis was already provided.

They would notice in the cost-sheet arrangement that depreciation had been included as an item of cost. Whilst that was necessary and justifiable, it did not follow that it would always be possible to preserve that reserve fund against the day of its requirements, especially if that plant was in fairly new condition. In bad times it might be found advisable to transfer that reserve to profit and loss account; but that would not be any reason why it should not be provided for. Unless a complete inventory of all the plant in a foundry was properly made, it was unwise to attempt anything in the nature of guesswork for that figure, especially if the firm had keen competition to face. Far better to leave it out altogether than for it to be badly done to jeopardise the prospect of orders.

Box Parts and Plates.

Where loam work was being made, it was usual for special plates to be made, and their cost, less scrap value, charged to the job; invariably they were broken up and sent to the cupola. Where such jobs were being made, care should be exercised to see that the ordinary moulding boxes account was not charged to them also. As to job costs, the value to be derived in taking out those individual costs was not measured by the result as a matter of interest. He attached to those individual histories a much greater value, a standard value. Every foundry should have its departmental cost, the cost of the whole workshop working over a fixed period, as a measure of its efficiency and ability to trade; but equally should it have its jobbing costs over the same period. The department cost might show a loss of £200. The job cost summary would very probably show one that there was a profit on a certain number of jobs totalling £300, and on other jobs a loss totalling £500—a net loss of £200, which must, of course, always balance to the department result. One could thus see how important those results could become. One should put the cost of the job where money had been lost against the estimated cost, and let the comparison light up the result. It was amazing what job costs revealed to those who were really seeking. A carefully built up departmental cost laid the foundation for more detailed jobbing costs, but sufficient had been established in the Paper to enable anyone to follow the trend of the building up of that most important side of the foundry's activities.

Comparativeness Essential.

All costs, to be really useful, must be comparative. To do that in a foundry was not an easy matter, because all the charges of a fixed nature, such as salaries, management, rates and general expenses, and many other works expenses, were fixed under normal conditions of trade. He had no doubt that that question of dealing with normal establishment charges in abnormal times had engaged everyone's attention on the managerial side of industry. In a machine shop, where the machine rate was in operation, the difficulty was simplified and became definable by a very simple calculation. The foundry, however, was a very different proposition, because it had no constant unit, like machines, to build upon, except it be the capacity of its cupolas. However, the arrangement of the cost sheet on the lines he had indicated brought them nearer a solution of the difficulty. One could fix a normal tonnage consistent with the normal standing charges, and say that that should be the standard for comparison. But it was possible that the foundry floor might be full of very large intricate work of a light nature, the total weight of which would not reach normal capacity at the cupola. Yet the wage bill might be higher than usual. Obviously it would not do, in a case like that, to suspend any fixed charges on a "cupola capacity basis."

Generally he favoured the ascertainment in each department of the foundry, under normal conditions of trade, of the percentage of overhead and general expenses, and in abnormal or depressed periods of trade that percentage should be applied to the direct wages, the difference to be suspended and charged direct to profit and loss account, exactly in the same way as the "idle time," as it was called in the machine shop, was dealt with. One could be sure under that method that comparative statistics would not suffer. One must remember that the percentage method was also unreliable at times, and apt to lead one astray unless one was alive to certain facts. An excess of work of an intricate nature led generally to a higher direct wages bill. With the overhead and general expenses remaining constant, one got a corresponding lower percentage expressed. On the contrary, an excess of a cheap variety of work corresponded to a lower wages bill. With the overhead and general expenses remaining constant, one got a higher percentage expressed. So, then, in fixing the normal, all factors must be reviewed.

Adaptability of the System.

The costing outline in the Paper could be adapted both to malleable and steel foundries with very few alterations. Each foundry could fit its own circumstances into the ideas laid down, and develop them accordingly. In the light castings trade there were more shops or departments to bring into the scheme; but those, too, could find in the outline presented the basis of a sound, practical system which would adapt itself to their special conditions.

Coremaking Costs.

The PRESIDENT, in thanking Mr. Wintle for his Paper and introductory remarks, congratulated him upon the thoroughness with which he had dealt with the subject. In his introductory remarks Mr. Wintle had anticipated many of the questions which might have been put. He would like to point out the great advantage of employing a member of the Chartered Institute of Works Accountants as against an ordinary accountant to advise with regard to what was a suitable foundry costing method. In the course of an interesting discussion at Leicester a few years ago on foundry costing they discovered one system of costing which had been introduced by an accountant to a foundry which carefully took note of all moulders' wages, but all coremakers were included in "sundry labour." That had the disastrous effect of making all jobs with cores comparatively cheap. The foundry owner, after some years, discovered that the particular casting he produced, which, on that costing, showed a very handsome profit per cwt., was actually costing him, when he reckoned the higher pay of his coremakers, far more than he sold it for in coremakers' wages only! It was no use appealing to any specialists in accountancy unless they were fully qualified by works' experience and knowledge. He did not want the owners or executive staffs of the smaller foundries to be scared by the mass of figures put before them. If one just studied them, one would find that, once these figures had been assimilated and one had obtained a summary, the operation had not to be repeated. One must get the total productive cost (what one actually paid the moulder and the coremaker), and the average total non-productive cost, which included the foremen, labourers, and even the furnacemen, if it was a shop which was run on average tonnage and average staff, and did not fluctuate very much in output. Even the fettlers could be included and calculated on a percentage on the moulders' and coremakers' wages. Obviously, the longer a moulder and coremaker worked on a job, the greater would be the on-labour cost. More assistance would be required from the labourers, and more time would probably be taken in fettling a cored casting, so that it automatically took care of itself. If it was not quite an accurate result, one got a fairly reliable costing. One had an excellent summary of the costs which ought to be included, but one would find, in normal years, the cost of the lining materials and other things would vary a little. So long as one watched the coke market and pig-iron market, one could establish a figure of so much per cwt.—6s. 6d., 7s. or 8s.—and one could modify that figure subject to a substantial alteration in the price of raw materials.

Internal and External Orders.

MR. E. LONGDEN asked what difference should be made in placing on-costs for quotations for outside firms as against the same article made for one's own works. That was a very common thing in some factories, that the former should not bear the same on-costs as castings for their own product. Had Mr. Wintle considered the total amount of metallic loss in the sand in melting, in fettling, and in carrying about the foundry? He stated something about 6 per cent. in melting, but had he considered the loss in handling?

A Liaison Officer Desirable.

MR. GOODWIN said they would realise, from the Paper, that Mr. Wintle was able to detail a concise and understandable mass of figures from which the foundry manager could detail out his report, backed by the job costs that had already been mentioned. In the old days they had a sort of general summary, but when it was all done it was merely a mass of figures. Nowadays they had it broken into sections. On the right-hand side one had the complete costs. On the other side, the details were summarised and totalled, which enabled one to realise where the extra cost had taken place from the right-hand total figures. There should be some liaison officer between the costing department and the works department. It was difficult for the costing clerk, the junior or the accountant to realise what he was costing. One must create a connection between the office staff and the man in charge of the other department, or his foreman. He greatly welcomed that in the works at Sheepbridge, because, then, the man was not merely sitting in the office working at masses of figures, but he could realise what was happening down at the foundry. It gave one qualms to realise that a job which was expected to pay had not done so, but the error could be found out from careful costings. One item which was sometimes overlooked in the foundry and in the costing department related to a job which in going

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through might have occupied floor space considerably longer than the average job on which the average on-costs had been taken from the shop. A liaison officer would obviate that error creeping into the costs. An intricate cored casting, especially a dry-sand casting, might take a fortnight or even two months to complete. The total weight of that casting would be so much, and on to it, for wages, should be carried certain on-costs. But that was not going far enough, when one realised the enormous time that it had occupied a number of square yards in the foundry and prevented further production. That was a little item which was not always looked at as carefully as it might be.

Loading the Metal Costs.

MR. LAKE congratulated Mr. Wintle on an excellent Paper. His Paper excelled over others because the author not only showed a fundamental knowledge of costing but of costings as applied to foundry work. He evidently had had enough experience in the foundry itself to be able to apply his principles of accountancy in a very successful manner. In his opinion, there was a very great difficulty in accurately proportioning the costs between the light intricate castings which took much moulders' and coremakers' time, with perhaps very little metal, and other jobs in which the main expense was the metal. That difficulty was best met by apportioning as large a proportion of the overheads as possible to the metal itself. He had found, by experience, that one obtained much better results in that way than by letting a large proportion of the overheads be apportioned to the direct labour. One piled as much on the metal as one could, so as to relieve the overheads on the moulders' and coremakers' wages. In that way, one ultimately got a much more accurate result. They all knew that it was necessary to have the monthly or weekly costs of the department as a whole. But, with regard to job costs, it could only be said that it paid for itself when dealing with foundries in which there were a comparatively small number of jobs dealing with large numbers of the same kind of thing. He had had experience of two operating foundries at the same time. One was making large numbers and from few patterns; the other one was making small numbers from a very large number of patterns. In the first case, it amply repaid the extra cost of taking out separately the cost of each job, and in the second case, he had never found that the extra cost was justified. Therefore, it was essential to have a costing system which was suitable for the particular needs of a foundry, and it took some consideration to judge what was best to suit the individual foundry.

MR. MOORE (Loughborough) said that Mr. Wintle's remarks were most interesting and valuable—even more interesting than his Paper. Did the small extra cost of the costing system absorb itself? The small amount of cost entailed, if it increased the turn-over and reduced the on-costs by the use of more direct labour, must be justified from any point of view. The on-costs must be known, and they must be absorbed. The question was raised referring to whether one was running a foundry alone or an engineering department with a foundry as an essential side of it. It seemed to him that did not matter; it was all a matter of knowing what one was doing. He agreed as to the necessity of costing departments and costing accountants knowing their job by being constantly in touch with the departments they were dealing with.

Large Unremunerative Orders.

MR. FAULKNER asked Mr. Wintle to explain the fallacy of taking on large orders at unremunerative figures in order to lower the overhead costs chargeable to the individual job?

MR. HARLEY (Coventry) said the Paper went to the root of their prosperity, or lack of prosperity. After all, they were in business to make money, Unless they knew on what jobs they were making money, and the jobs on which they were losing money, they did not know where they were. Mr. Wintle was not only an expert accountant, but he seemed to be an expert foundryman; he knew precisely and exactly the different operations going on in the foundry and their relative importance. In costing, where the cost of the metal was relatively high, as in the steel foundry, and where the proportion of gates and runners was perhaps also relatively high in regard to the weight of the casting, he thought the cost, so far as the cost of the molten metal was concerned, should be the cost plus its gates and runners. In other castings, where the weight of the casting was high and the weight of the runners was small, it did not matter so much, but in the steel foundry it happened more often the other way. The actual cost of the metal in that casting was very high in some sections, apart altogether from the moulding costs, and the return value of the scrap was comparatively small compared with the cost of producing the steel which went into the runners. Apart altogether from what was done in taking out individual costs, he agreed that it was essential, no matter what the foundry was doing, or how many different classes of castings that they were dealing with, that they should have at least a monthly manufacturing account. Every month one should have that danger signal to tell one which way things were going. From that manufacturing account, one could see whether one had made any money or not. It did not tell one where one had made money, or where one had lost it, but one saw the net result, and from that one could derive very valuable data from the following month.

AUTHOR'S REPLY.

MR. WINTLE, replying to Mr. Longden, said: The loading of a different percentage of establishment charges to castings for works consumption, as against those for outside sales, was rather strange from the cost accountant's point of view.

Assuming both lots of castings had been made under the same condition of manufacture, one failed to see any difference in the cost. But presuming the loading was done, it must incline heavily towards the works castings in order to lighten the cost of customers' castings and to make the selling price of such castings an attractive proposition.

One could appreciate that this is possible if the proportion of castings for works consumption was a fairly steady percentage of the output, but how the balance was kept level if they are not, must certainly be a little dangerous. In any case, the questioner would appreciate the fact that the establishment charges were necessarily higher on the works than they need be by this method, and the peculiarly unsatisfactory position arose from what appeared to be mere juggling with figures. Such unreliable deductions resulted in the following:—(1) An untrue value of works castings for consumption; (2) an untrue cost of customers' castings; and (3) an untrue cost of the real overhead charges. The recognised way to charge works with castings for own consumption was to make the open market the judge. If the selling price was lower than cost price, there is a double loss to bear which might work out to the same approximate result as the overloading method.

But the most important feature was retained. One obtained the true relative costs, which at least should be striven for. One could juggle with selling prices if one liked, but never with costs.

What Melting Losses Comprise.

The loss of 6 per cent. shown in the summary cost was the melting loss only. Any other losses due to heads, runners, risers, etc., was shown between the cost of the metal into the cupola, and the residual value of the amount left behind after the casting was fettled. It was generally assumed that this weight of metal was all returned to the cupola in due course, but the loss measured in terms of percentage is roughly from ½ to 1 per cent.

Replying to Mr. Lake, Mr. Wintle said that the policy of loading as much as possible of the overhead costs on to the weight to relieve the direct labour "on cost" was a matter for very careful consideration. It could be clearly defined in the case of the cupola what proportions of expense should be borne (see summary cost). In the matter of those other charges enumerated under Item 7, they were really representative of services rendered on the basis of time a job was in the foundry, and should, strictly speaking, be expressed as a percentage on the whole of the direct labour in the foundry. Therefore one could not endorse such a policy without knowing the full circumstances. It would appear another case of jugglery.

Regarding the value of job costs as being overrated, one can quite conceive, where a foundry is making castings of such a nature as to produce no violent fluctuation in cost, then quite rightly the job cost should give way to "class costs." The total summary cost was not sufficient guidance to good management and salesmanship.

Large Orders at Unremunerative Prices.

As to proving the fallacy of taking in a lot of orders at unremunerative prices to bring down the cost of overhead charges, as cited by Mr. Faulkner, strictly speaking one did not bring down the cost of establishment charges in terms of money by taking on more work. Expressed as a percentage on direct-labour or as a cost per ton, this reduction was true. One must assume that there was a fair quantity of work coming in at normal prices, which was presumably "paying." Much depended on what proportion of the normal establishment charges was recovered by these orders, and whether in consequence it was advisable to take on more work at prices which did not pay.

The only justification for doing this would be when the normal trading tonnage was reached and therefore abnormal conditions brought about in the shop. Here we came face to face with elementary economic teaching that as the demand would be exceeding the supply there would be no need to take work at unremunerative prices.

In the case of a foundry where work at normal prices could be obtained, it certainly appeared a fallacy, because no good purpose was apparently served; the resulting loss probably equalling the loss of keeping the place idle altogether. But there were one or two factors which must be taken into account. If the business was competitive, by taking some proportion of orders at low prices, one kept the name of the company advertised and held together a nucleus of custom. It also provided employment and kept together the personnel of the establishment. Much, of course, depended on the resources of a company. One could not say with any definite conclusion that to take orders on at unremunerative prices was fallacious.

When occasion arose, every shop must work it out for themselves, with all the conditions known, before a decision was reached. The deflating of the market in consequence of a decision to take such orders, if expensive, was a very serious business, and tended to lower the tone all round, which might have lasting effects.

In this connection the author quoted from an article by Mr. F. T. Clapham, who stated: "There is another curious instance of the unrealised value of establishment charges, which I should like to bring before you. I once obtained a foreign order for £30,000 worth of work, amongst which was 150 tons of C.I. special pipes. These specials were included in our estimate at £11 per ton. The foundry was badly equipped in one or two notable things, and, in consequence, was short of work. One of my directors sent out an inquiry for those specials and obtained a quotation for them at £10 10s. per ton. He said to me: 'I think it advisable to buy these out. In any case we stand to get a clear profit of £75, because I can buy the whole lot at 10s. per ton cheaper than our estimate.' 'Exactly,' I replied, 'but while you are getting £75 clear profit, you are paying away your own establishment charges.' 'How do you mean?' 'Just this. Our moulders can make these pipes at £2 per ton. The establishment charges, including cupola cost, are 30s. per ton. On 150 tons this works out at £225; deduct the £75 profit you say you can make, there remains a net loss of £150 charges.' I need hardly add that we made those pipes in the foundry, and although they cost the £11 a ton of the estimate, we actually earned £225 of charges, which were a great help to the inevitable running costs of the shop."

Vote of Thanks.

The President thanked Mr. Wintle, on behalf of the Convention, very much for his Paper and his introductory and other remarks. Any elaboration of his replies could be printed in the proceedings.

The Shrinkage of Cast Steel.

F. Körber and G. Schitzkowski* have recently made investigations on the shrinkage of cast steel. In practice the shrinkage of cast steel is generally assumed to be 2.0 per cent. Large and wide-spreading castings, however, such as roll-housings, gear and fly-wheels, often behave quite differently, which sometimes involves a costly machining, though the special shrinkage of these castings can be counterbalanced by the practical experience of the patternmaker and the moulder. For the solution of the problem it is essential to know how the shrinkage succeeds from the beginning of the solidification until room temperature is reached with castings which show a uniform cooling rate in all their parts and which do not encounter any resistance on the part of the mould. Furthermore, there must be known how the shrinkage is influenced by the shape of the casting and by the condition of the mould.

The experiments in question were carried on (*a*) with plain round bars; (*b*) with bars with large flanges which hindered the shrinkage, and (*c*) with bars with flanges the shrinkage of which was limited by rigid iron rods put into the mould. There were made two series of experiments, the one with acid open-hearth steel, the other with basic open-hearth steel. The shrinkage was measured by the shrinkage meter constructed by Wüst. The bars were cast horizontally, the hot junction of the thermo-couple being in the surface of contact between the bar and the gate.

Experiments with Acid Steel.

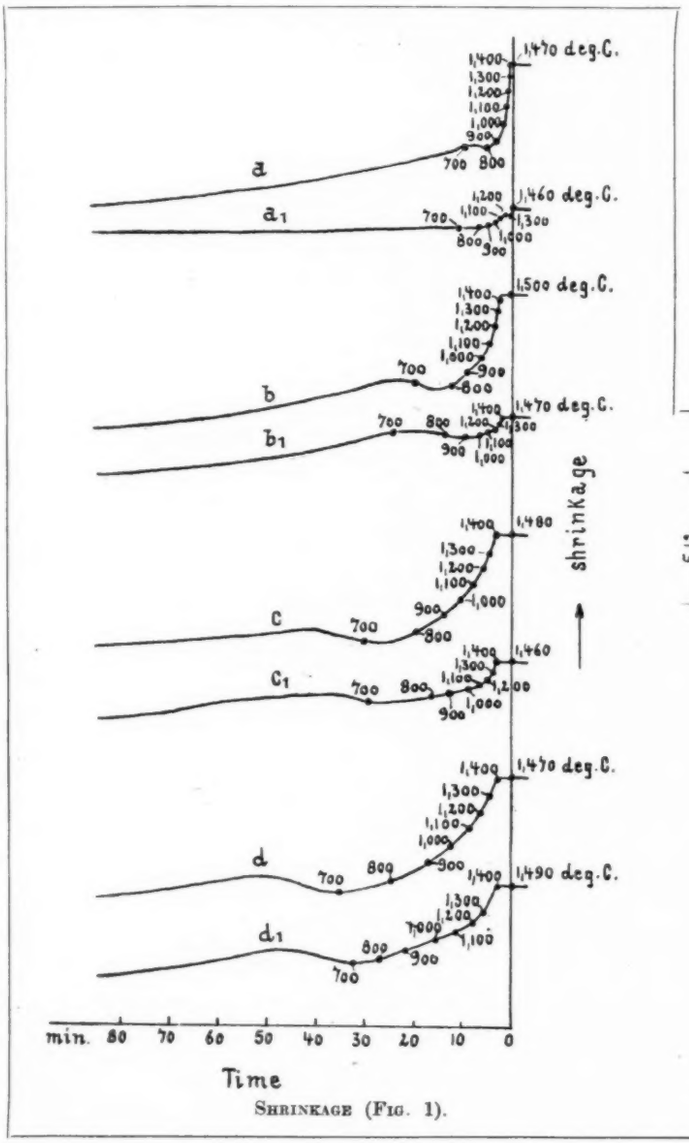
The composition of the steel was 0.28 per cent. carbon, 0.22 to 0.60 per cent. silicon, 0.26 to 0.69 per cent. manganese, 0.063 to 0.106 per cent. phosphorus, and 0.036 to 0.085 per cent. sulphur.

(*a*) *Plain Round Bars.*—The bars had a length of 17.72 in. and a diameter of 0.787, 1.181, 1.575 and 1.969 in. respectively; they were cast into green-sand moulds. The shrinkage curves are nearly the same as that of the bars with flanges cast into green-sand moulds (see Fig. 1, *a* to *d*.). The average values of two experiments are recorded in Table I; the highest point of the curves was taken for the pearlite point. The test values show that the shrinkage is independent of the diameter of the bars.

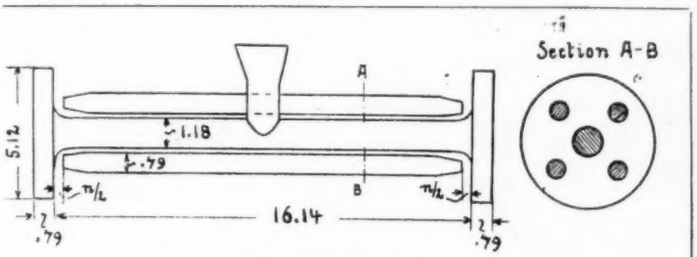
TABLE I.

Diam. of bar.	Total shrinkage.	Shrinkage Before the critical point.	Shrinkage After the critical point.	Casting temperature.
Ins.	Per cent.	Per cent.	Per cent.	Deg. C.
0.787	2.20	1.19	1.01	1,480
1.181	2.18	1.21	0.97	1,460
1.575	2.13	1.06	1.07	1,450
1.969	2.16	1.20	0.96	1,490

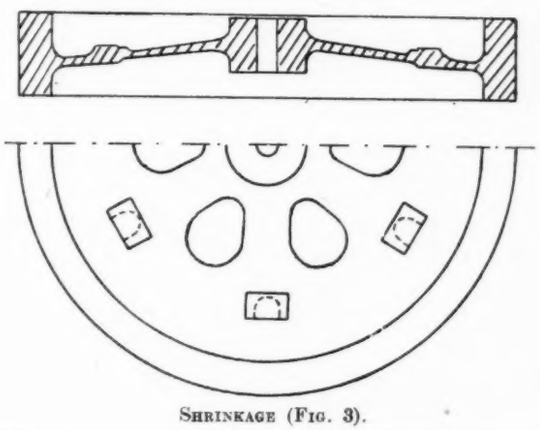
(*b*) *Bars with Flanges.*—The bars had a length of 17.72 in. and a diameter of 0.787, 1.181, 1.575 and 1.969 in. respectively; the flanges had a thickness of 0.787 in. and a diameter of 4.73, 5.12, 5.51 and 5.51 in. respectively. There were made two series of experiments; in the first series it was intended to impede the shrinkage of the bars very little; therefore the green-sand between the flanges was lightly rammed. In the second series the green-sand was replaced by a mixture of compo (chamotte), fireclay and graphite, and the moulds were dried. The shrinkage values of the two series are given in Table II. The shrinkage curves of the bars cast into green-sand moulds (Fig. 1, *a* to *d*) are similar to that of the plain round bars. The slope of the curves, which is very steep in the case of the bar of 0.787 in. diam., is gradually smoothed with the increasing diameter due



SHRINKAGE (FIG. 1).



SHRINKAGE (FIG. 2).



SHRINKAGE (FIG. 3).

TABLE II.

Diam. of bar.	Condition of the mould.	Shrinkage curve (Fig. 1).	Total shrinkage	Shrinkage Before the critical point.	Shrinkage After the critical point.	Casting temperature	
Ins.			Per cent.	Per cent.	Per cent.	Deg. C.	
0.787	Green.	a	2.03	1.01	1.02	1,470	No fracture.
	Dry.	a_1	0.34	0.21	0.13	1,460	Fracture.
1.181	Green.	b	2.13	1.12	1.01	1,500	No fracture.
	Dry.	b_1	0.61	0.18	0.43	1,470	Fracture.
1.575	Green.	c	2.07	1.06	1.01	1,480	No fracture.
	Dry.	c_1	0.89	0.41	0.48	1,460	Fracture.
1.969	Green.	d	2.19	1.18	1.01	1,470	No fracture.
	Dry.	d_1	1.78	0.89	0.89	1,490	Fracture.

* Stahl und Eisen, 1928. No. 5, pp. 129-35. No. 6, pp. 172-8.

to the decreasing cooling rate. At the same time the period required for passing the critical stage is increased. The bars did not show any defect. The shrinkage curves of the bars cast into dried moulds (Fig. 1, a_1 to d_1) show a deviation from the normal course at about 1,300 deg. C. By this deviation there is indicated the fracture of the bars. In the case of the bars of 0.787 and 1.181 in. diam., both the flanges had been torn off. The bar of 1.575 in. diam. showed a fracture in the middle below the gate extending across the whole area; the same was the case with the bar of 1.969 in. diam.; here, however, the fracture did not extend but across three-quarters of the section. The fractures did not show any plastic deformation.

TABLE III.

Total distance between the tops of the rods and the flanges.	Bar.	Total Shrinkage.	Shrinkage Before the critical point.	Shrinkage After the critical point.	
Ins.	No.	Per cent.	Per cent.	Per cent.	
n = 0.079	a	1.51	0.51	1.00	Bar torn near the flanges.
0.158	b	1.45	0.44	1.01	Do.
0.236	c	1.68	0.65	1.03	Do.
0.315	d	1.75	0.69	1.06	—
0.394	e	1.79	0.76	1.03	—
0.473	f	2.10	1.04	1.06	—

(c) *Bars with Flanges and Iron Rods in the Mould.*—In practice the size of the resistance of the mould will be between the two cases inquired above, the lightly rammed green-sand mould and the hard rammed dry-sand mould. According to the condition of the mould the resistance can appear at various temperatures and at various strength. To meet the conditions encountered in practice experiments were made with flanged bars of 1.181 in. diam. the shrinkage of which was impeded by iron rods of .787 in. diam. put between the flanges (see Fig. 2). The total distance between the tops of the rods and the flanges was 0.0787, 0.1575, 0.2362, 0.315, 0.3937 and 0.4724 in. In the two last cases this distance was greater than the total shrinkage, which was about 0.3543 in. But it must be remembered that the sand which was lightly rammed between the tops of the rods and the flanges was pressed together during the shrinkage of the bar and diminished the distance. The bars were cast into green-sand moulds. The shrinkage values are given in Table III. The shrinkage curves showed a deviation from the normal course which occurred with bar a at about 1,300 deg. C., with bar b at about 1,250 deg. C., with bar c at about 1,225 deg. C., with bar d at about 1,100 deg. C., and with bar e at about 1,150 deg. C. The shrinkage curve of bar f showed a very slight deviation at between 1,100 and 1,200 deg. C. From Table III it is to be seen that the total shrinkage increases with the increasing distance between the rods and the flanges and that it is the shrinkage before the critical point which is altered. The shrinkage after the critical point is always the same and is about 1.0 per cent. By inspection with the naked eye the bars Nos. d to f did not show any defect, but when a layer of about 0.039 in. was turned off small cracks were to be seen near the flanges connected with a small pipe in the flange.

Experiments Using Basic Open-Hearth Steel.

The steel had the following composition: 0.15 to 0.39 per cent. carbon, 0.32 to 0.47 per cent silicon, 0.49 to 0.80 per cent. manganese, 0.014 to 0.047 per cent phosphorous, and 0.021 to 0.045 per cent. sulphur. Experiments were made with flanged bars cast into green and dry sand moulds and with flanged bars the shrinkage of which was impeded by iron rods put into the green-sand moulds. The shrinkage curves showed the same course as that of the acid open-hearth steel. The shrinkage values of the flanged bars are given in Table IV; there are also recorded the time required for the shrinkage before the critical point was reached and that necessary for passing the critical range. These two values are of great importance in considering the movements of castings in the mould during the shrinkage period. The shrinkage values of the experiments with iron rods put between the flanges are given in Table V. The bars a and b were torn near the flanges to such an extent that the experimental data are of no value. The other bars showed fine cracks near the flanges when a small layer was turned off.

TABLE IV.

Diam. of bar.	Condition of mould.	Total shrinkage.	Shrinkage Before critical point.	Shrinkage After critical point.	Casting temperature.	Time for shrinkage before critical point.	Time for passing critical range.	
Ins.		Per cent.	Per cent.	Per cent.	Deg. C.	Min.	Min.	
0.787	Green.	1.99	0.94	1.05	1,480	4.78	3.72	No fracture.
	Dry.	0.55	0.07	0.48	1,450	—	—	Fracture.
1.181	Green.	2.10	1.05	1.05	1,460	14.9	13.3	No fracture.
	Dry.	0.43	0.20	0.23	1,440	—	—	Fracture.
1.575	Green.	2.10	1.07	1.03	1,500	26.0	15.4	No fracture.
	Dry.	0.50	0.32	0.18	1,500	—	—	Fracture.
1.969	Green.	2.08	1.05	1.03	1,480	37.5	24.3	No fracture.
	Dry.	0.91	0.38	0.53	1,485	—	—	Fracture.
3.937	Green.	2.20	1.18	1.02	1,510	67.5	54.7	No fracture.

In further experiments the formation of cracks in steel castings of simple and intricate shapes was examined, and it was found that besides a uniform wall thickness, the construction of ribs in the critical sections and the arrangement of the gate, it is necessary to use lightly rammed moulds and cores and to take the casting out of the mould after pouring as quickly as possible. The critical temperature at which the cracks are formed is about 1,300 deg. C., as is seen from the foregoing experiments, and the period elapsed until this temperature is reached depends upon the casting temperature, the temperature of the mould, and the heat conductivity of the moulding sand. For castings with a thin wall thickness this period is very short, as can be seen from Table VI, where the values for the flanged bars are recorded.

TABLE V.

Total distance between the rods and the flanges.	Bar.	Deviation of the shrinkage curve at about	Total shrinkage.	Shrinkage Before critical point.	Shrinkage After critical point.	
Ins.	No.	Deg. C.	Per cent.	Per cent.	Per cent.	
n = 0.079	a	1,300	0.56	0.06	0.50	Bar torn near the flanges.
0.158	b	1,250	1.14	0.31	0.83	Do.
0.236	c	1,150	1.54	0.57	0.97	—
0.315	d	1,150	1.61	0.59	1.02	—
0.394	e	1,050	1.88	0.89	0.99	—
0.473	f	—	2.16	1.17	0.99	—

TABLE VI.

Diam. of bar.	Period for reaching the temperature of 1,300 deg. C. Acid steel.	Period for reaching the temperature of 1,300 deg. C. Basic steel.	Casting temperature. Acid steel.	Casting temperature. Basic steel.
Ins.	Min.	Min.	Deg. C.	Deg. C.
0.787	1	1	1,470	1,480
1.181	3	2	1,500	1,460
1.575	5	5	1,480	1,500
1.969	6	6	1,470	1,480
3.937	—	8	—	1,510

Wheels of large diameters often show a distortion of the rim which is caused by the unequal shrinkage of the rim and the spokes. This distortion is avoided when a disc, solid or parted, is used instead of the spokes. In order that the disc is not broken by the shrinkage pressure of the rim, it must be made of a conical shape, as is illustrated by Fig. 3. The movements of the boss and the rim of such a wheel from the beginning of the solidification until a temperature of about 400 deg. C. was reached was examined.

Leicester Convention Hospitality Fund.

This fund reached what we believe to be a record figure of £532 9s. 6d. The organisers, especially Mr. H. H. Moore, are to be congratulated on the success which has attended their efforts. Below we give the final list of the subscriptions received:—

	£	s.	d.
Thos. E. Gray & Company, Limited, London	5	5	0
James Evans & Company (Manchester), Limited, Manchester	5	5	0
Mr. T. F. Suffolk, Nottingham	3	3	0
British and Continental Traders, Limited, London	3	3	0
Macnab & Company, London	3	3	0
Edward Stevenson, Limited, Nottingham	2	2	0
Powell Duffryn Steam Coal Company, Limited, Cardiff	2	2	0
The Oughtibridge Silica Firebrick Company, Limited, Oughtibridge, near Sheffield	2	2	0
Denbigh Engineering Company, Tipton	2	2	0
Renishaw Iron Company, Limited, Chesterfield	2	2	0
Bradley & Foster, Limited, Darlaston	2	2	0
J. B. Corrie & Company, Limited, London	2	2	0
E. G. Acheson, Limited, London	2	0	0
J. Hinckley & Son, Sheffield	1	1	0
T. Fearnley Allen & Son, Birmingham	1	1	0
The Rapid Magnetting Machine Company, Limited, Birmingham	1	1	0
J. G. Shields, Breedon and Cloud Hill Lime Works, Isley Walton, Derby	1	1	0
Cawood & Company, Limited, Leeds	1	1	0
Mr. A. W. Brook, Leicester	0	10	6
Members at Ley's Malleable Castings Company, Derby	4	0	0
Mr. H. Pemberton, Derby	3	3	0
Mr. W. Stobart, Derby	1	1	0
Mr. R. T. Russell, Derby	1	1	0
Mr. C. Blades, Syston	1	0	0
Members at Hammonds & Company, Syston	1	0	0
Mr. W. Glover, Derby	0	10	0
Mr. F. G. Butters, Ilkeston	0	5	0

B.S. Specifications for Chemical Lead and Regulus Metal.—The British Engineering Standards Association has recently issued new Specifications for Chemical Lead (No. 334—1928) and Regulus Metal (No. 335—1928). Copies of these are available from the Publications Department of the Association (28, Victoria Street, Westminster, S.W.1). Price 2s. 2d. each, post free.

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Trade Talk.

THE WEST OF INDIA PORTUGUESE GUARANTEED RAILWAY COMPANY, LIMITED, reports that in 1927 their railway carried 173,000 tons of manganese ore, and 22,000 tons of chrome ore for shipment from the port of Mormugao.

THE PUBLIC examination of Mr. J. G. Gillam, trading as Graham Gillam & Company, steel merchant, 43, Johnson Street, Westminster, London, will take place on September 4, at Bankruptcy Buildings, London, W.C.2.

THE COWPEN SHIPBUILDING AND DRY DOCKS COMPANY, LIMITED, have received an order from Mr. R. S. Dalgliesh, of Newcastle, for a cargo steamer of 3,400 tons. The engines will be supplied by Messrs. Blair & Company, Stockton.

A MEETING OF the Empire Industries group of Conservative M.P.'s, held at the House of Commons on July 10, decided to appoint a deputation to wait on the Prime Minister to urge the immediate safeguarding of the iron and steel trades.

THE TREASURY HAVE made an Order under Section 10 (5) of the Finance Act, 1926, exempting vanadium-silica compounds specially prepared for use as catalysts for sulphuric acid manufacture from key industry duty from July 9 to December 31, 1928.

MESSRS. J. W. NAYLOR and I. H. Abelson, carrying on business as steel manufacturers at Princess Works, Rockingham Street, Sheffield, under the style of Sheffield Steel Alloys, have dissolved partnership. Mr. J. W. Naylor is continuing the business.

THE ASCERTAINED PRICE of West Coast hematite mixed numbers for May and June is 68s. 7d. per ton, a reduction of 1s. 10d. compared with the previous ascertainment. The sliding-scale percentage on the base rates, tonnage and basic earnings is 20¾ per cent.

THE AVERAGE NET selling price of No. 3 Cleveland pig-iron for the second quarter of the year has been certified at 62s. 11.61d., or 0.62d. below that of the previous quarter, which reduces the North-East Coast blast-furnacemen's wages by ¼ per cent. for the current quarter.

THE UNITED STATES STEEL CORPORATION and its 92 subsidiary companies have brought an action in the United States Court of Claims to recover $101,582,180 (£20,316,436), which, it is claimed, represents overpaid income and profits tax for 1917 plus $9,359,862 (£1,870,000) interest.

STATISTICAL RETURNS CONCERNING the iron and steel industry of Austria during May show that the blast-furnaces worked to 68 per cent. of their capacity, steel works to 93 per cent. of their capacity, and sheet rolling mills to 98 per cent. capacity. Orders received by Austrian iron and steel firms during May amounted to 90 per cent. of their productive capacity.

AT A MEETING of the Committee of the Shipbuilding Employers' Federation it was reported that the five craft unions—Boilermakers, Shipwrights, Plumbers, Tinkers, and the Electrical Trades—had accepted the employers' offer of an increase of bonus payment of 3s. per week in the case of plain time workers, making the bonus 10s. instead of 7s. per week as at present.

THE LOUGHBOROUGH COLLEGE Governors invite applications for the award of five open scholarships in the faculty of engineering, each of the value of £75 per annum. The scholarships are open to British subjects situate in any part of the Empire, and are tenable at Loughborough College, Leicestershire, for the period of the full diploma course. Further particulars and application forms may be obtained from the College Registrar.

IT IS ANNOUNCED by Imperial Chemical Industries Limited, that the new issue of 3,363,855 ordinary shares of £1 each and 2,242,570 deferred shares of 10s. each was heavily over-subscribed to the extent of more than £11,000,000. The number of shares in respect of which the rights to subscribe were not exercised was so small in relation to the surplus number of shares applied for that the directors decided to allot these surplus shares to shareholders who are in the employ of the company and its subsidiaries.

THE ADJOURNED MEETING of the 7½ per cent. debenture stockholders of Baldwins, Limited, was held in London on July 11, when the directors' scheme of reorganisation, with certain modifications, was approved. As the result of the modifications, the stockholders, instead of 35 per cent. of their capital in the form of a fixed debenture, will receive 50 per cent. of it in that form; the rate of interest on the income debenture stock will be increased from 5 per cent. to 6½ per cent., and the scheme will be retrospective as from January 1, which in terms of money will involve the immediate payment of £79,237, as against £68,670. In addition, the 7½ per cent. debenture stockholders are to have direct representation on the board.

A MEETING OF THE holders of the 5 per cent. first debenture stock of the Barrow Hematite Steel Company, Limited, was held recently to consider the company's request for authority to create £200,000 prior lien debentures and also for a moratorium in respect of interest on the debenture stock until December 31, 1930. Sir William B. Peat, who presided, said the stockholders would have gathered that there was some opposition to the proposals, and it had been suggested that the most satisfactory course would be to adjourn the meeting for a fortnight in order that the representatives of the debenture holders who were not in accord with the scheme and the company and its officers might confer with the object of endeavouring to arrive at a solution which would be acceptable to both parties. This proposal was accepted by the meeting, which was accordingly adjourned for a fortnight.

ACCORDING to reports from the U.S. Consular agent at Shanghai, Chinese producers of tungsten and middlemen in the interior, particularly in Kiangsi Province, which furnishes nearly all of the wolframite passing through Shanghai, are forming a co-operative organisation with the idea of regulating the quantity offered to the market. Shanghai Chinese tungsten dealers report a fair market in Shanghai during the first quarter of 1928, although there was only small inquiry from the United States. Inquiry from Europe is reported to have been fairly strong. A small but steady advance brought prices at the end of the quarter to 26 to 27 Mexican dollars a picul (133⅓ lbs.) for ore containing 68 per cent. or more of WO_3. (The Mexican dollar has an exchange value of about 2s.) This was the price paid in Shanghai to the up-country collector and not the export price, which depended on the precise analysis.

THE NAME OF the Derwent Foundry Company (1920), Limited, of Derby, has been changed to Qualcast, Limited, and the company has become a public one with considerably increased resources. The capital of Qualcast, Limited, is £125,000, all in ordinary shares of 5s. each. There are no debentures. The liabilities to trade creditors are in no way affected. The proceeds of the recent issue of shares are required for the erection and equipment of new works upon freehold land owned by the company, and to provide additional working capital. The foundry section of the new works, which it is intended shall have an increased capacity of 50 per cent., should be ready within nine months, and before the expiry in 1930 of the lease of the present factory, the whole of the company's business will be transferred to the new works. The directors are Messrs. J. E. V. Jobson (chairman), C. W. Bigg, O. J. Jackson, and F. S. Richardson. The firm's new telegraphic address is "Qualcast," Derby.

Contracts Open.

Halifax, July 23.—1,200 tons of cast-iron water pipes varying in diameter from 48 in. to 12 in., for the Town Council. Mr. E. P. Brook, waterworks engineer, Halifax. (Fee £2 2s., returnable.)

Johannesburg, August 23.—Structural steelwork, bars and 4,860 lbs. of spring-steel wire, for the South African Railways and Harbours. The Department of Overseas Trade. (Reference A.X. 6534.)

Johannesburg, August 23.—Structural bridge work in three 30-ft. deck spans, for the South African Railways and Harbours. The Department of Overseas Trade. (Reference A.X. 6536.)

Johannesburg, August 23.—Structural steelwork, for the South African Railways and Harbours. The Department of Overseas Trade. (Reference A.X. 6537.)

London, S.W., July 20.—Dog spikes, screw spikes, fishbolts and nuts; steel bearing plates for F.B. rails, etc., for the South Indian Railway Company, 91, Petty France, Westminster, S.W.1. Messrs. R. White & Partners, 3, Victoria Street, Westminster, S.W.1.

London, S.W., July 24.—Steelwork lift framing, for the Commissioners of H.M. Works, etc. The Contracts Branch, H.M. Office of Works, King Charles Street, London, S.W.1. (Fee £1 1s., returnable.)

London, S.W., July 25.—Girder bridge spans of 15, 21¾ and 30 ft. (approximate total tonnage 55½), for the Madras and Southern Mahratta Railway Company, Limited, 25, Buckingham Palace Road, Westminster, S.W.1. (Fee £1 1s., non-returnable.)

Melbourne, July 25.—15 tons of mild-steel angles, 65 tons of mild-steel channels, and 5 tons of mild-steel "I" beams, for the Victorian Railways. The Department of Overseas Trade. (Reference A.X. 6532.)

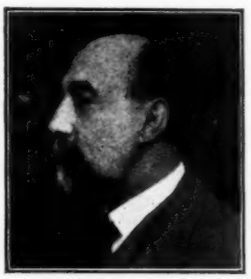
Montevideo, September 6.—85.000 mild-steel rounds, 400 bundles of mild-steel rods, 4,700 mild-steel angles, 4.500 right-angled mild-steel bars, 180 black flat sheets, 500 galvanised iron sheets, and 3.000 coils of galvanised iron wire, for the State Electricity Supply Works. The Department of Overseas Trade. (Reference A.X. 6538.)

Portobello, July 23.—Structural steel work, for the Edinburgh Town Council. Mr. E. J. MacRae, city architect, City Chambers, Edinburgh.

Personal Paragraphs.

SIR DAVID BROOKS, Mr. C. Herbert Smith, and Sir Gilbert Vyle have been elected directors of Radiation, Limited, Birmingham.

MR. H. J. SKELTON resigned the chairmanship of the Committee of the London Iron and Steel Exchange at a meeting last week. He is succeeded by Mr. Watson Slack. Mr. Skelton, who has been chairman of the Committee of the London Iron and Steel Exchange since its formation in 1919, has just reached his seventieth birthday. He told the Committee that he felt he could legitimately take more rest, but would continue to serve on the Committee. Mr. James Whitby said he had come to the meeting with the intention of proposing Mr. Skelton's re-election. Under the circumstances, however, he readily acceded to his (Mr. Skelton's) wishes, and extended to him the thanks of the Committee for the valuable services he had rendered during his term of office.



MR. H. J. SKELTON.

Wills.

OTT, E. H., of Sheffield, manager of Messrs. Hadfields, Limited, steelworks £6,060

CUMNOCK, R. N., of Gourock, of Messrs. McAlister & Fyfe, engineers and shipbuilders £10.299

WIGHT, G. O., chairman of Messrs. Wight & Company, Limited, iron and steel and metal merchants, Sunderland £23.274

Reports and Dividends.

Steel Developments, Limited.—Interim dividend of 3 per cent., tax free.

Crompton Parkinson, Limited.—Dividend on the preferred ordinary shares at the rate of 6 per cent. per annum for the six months ended June 30, 1928.

Dickson & Mann, Limited.—Net profit, £1,549; adverse balance brought forward, £1,480; written off reconstruction expenses, £453; leaving a deficit of £384 to be carried forward.

William Asquith (1920), Limited.—Net profit, £8,418; brought forward, £8,685; income-tax assessments discharged and written back, £5,534; dividend for twelve months at rate of 8 per cent., less tax, on preference shares; carried forward, £5,513.

Broughton Copper Works (1928), Limited.—Trading profit, after charging depreciation and directors' fees, but before charging income-tax and loan interest, £66,348, as against the prospectus estimate of £69,696. Out of this sum there has been paid to the vendor company £62,650 in accordance with the agreement for purchase.

Allen-Liversidge, Limited.—Net profit, £72,591; brought forward, £7,018; to general reserve, £25,000; reserve against freehold properties, £4,000; interim dividend on ordinary shares, £15,000; preference dividends, £13,000; final dividend of 5 per cent., less tax, on ordinary shares, making 10 per cent. for the year, £15,000; carried forward, £7,609.

Mond Nickel Company, Limited.—Gross profit, £776,833; brought in, £33,189; debenture interest, £74,118; general charges, £60,286; suspense account, £50,000; directors' fees, £29,621; final dividend on the ordinary capital of 4s. per share, subject to tax, making 5s. 6d. per share; to mortgage debenture stock reserve, £16,125; to reserve, £40,000; carried forward, £29,871.

Obituary.

MR. P. D. DONALD, engineer to the Clyde Navigation Trust, died recently in Glasgow.

MR. R. POWELL, proprietor of Messrs. Perkins & Powell, brassfounders, Bartholomew Row, Birmingham, died recently.

MR. ROY MCGREGOR LAIRD, whose death took place suddenly at Windermere on July 8, was a director of the Tranmere Bay Development Company, Limited, one of the subsidiaries of Messrs. Cammell Laird & Company, Limited, of Sheffield and Birkenhead. During the war and for several years previously he was in charge of the ship-repairing department of Messrs. Cammell Laird & Company, and was awarded the C.B.E. for his services in connection with the repair of naval and merchant vessels damaged by enemy craft.

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SHEFFIELD.

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Iron and Steel Markets.

Pig-Iron.

MIDDLESBROUGH.—Conditions in the Cleveland iron trade remain without visible signs of alleviation from the long-enduring depression which has overtaken this once great national industry. Markets are practically deserted, as the weeks pass with no improvement in outlook as concerns the immediate future. Market opinion at the moment is distinctly inclined to a pessimistic view of the position, production being steadily restricted in the Tees-side area, where eight furnaces have gone out of operation so far this year, while other reductions of output are in contemplation. Competition at home is also becoming more aggressive, Midland furnaces now offering iron on much cheaper terms than Cleveland can afford, or is willing to grant, while for export quotations still rule at levels which offer little encouragement to foreign buyers. With Cleveland makers still adhering firmly to previous quotations, there is no inducement to consumers to enter upon forward contracts, and business is therefore entirely confined to almost retail proportions at prices as follow:—No. 1 Cleveland foundry iron, 68s. 6d. per ton; No. 3 G.M.B., 66s.; No. 4 foundry, 65s.; No. 4 forge iron, 64s. 6d. per ton.

Similar conditions to those above outlined in regard to foundry iron apply with equal force to the Tees-side hematite market, with prices decidedly weaker, quotations ranging from 68s. to 69s. for East Coast mixed numbers. On the North-West Coast 70s. for Bessemer quality, at works, is quoted.

LANCASHIRE.—Holiday influences have had a quietening effect upon local markets for foundry pig, very few transactions having been put through during the current week. Price-cutting on a moderate scale is still in evidence, with quotations ruling about as follow:—Derbyshire No. 3, 68s. to 68s. 6d.; Staffordshire, 68s. to 68s. 6d.; Scotch, 87s. 6d., all per ton delivered Manchester or equal.

THE MIDLANDS.—In South Staffordshire the foundry industry is experiencing a very slack time at present, and consequently demand for raw material is exceptionally restricted in volume. Meanwhile, the furnaces are still increasing their stocks, as the demand does not absorb their make. Derbyshire No. 3 is quoted at 60s., Northants. at 55s. to 55s. 6d., and North Staffordshire No. 3 60s. per ton, at furnaces. Lincolnshire No. 3 is quoted at 72s. 6d. per ton delivered, and Scotch No. 3 iron at 89s. per ton delivered.

SCOTLAND.—The works in Glasgow and district having closed down for the annual Fair Holidays, which will extend in some cases to July 30, business is exceedingly quiet. Prices are inclined to be firmer on the basis of 70s. for No. 3 foundry f.o.t. furnaces.

Finished Iron.

Although reports from local centres on the position of the manufacturing branches are by no means uniformly hopeful, a glance at the current issue of the Board of Trade returns inspires a more encouraging view of the conditions, the official figures showing that we are importing much less of all kinds of iron and steel products and exporting much more. In the Black Country area none of the ironworks is in a position to keep mills fully occupied, as business is being done on very restricted lines. The works making marked bars are not so badly off, but even they are finding things somewhat difficult, and bulk orders are not coming along just at present. The price for this grade is £12 per ton at makers' works. Crown iron is on offer between £9 and £9 15s. per ton delivered here, and there is much competition for the limited amount of business which is developing from consumers and merchants. Makers of nut and bolt iron are having very little support from the Darlaston area, as it is not possible for consumers to pay their figure of £8 7s. 6d. to £8 15s. while the Continental figure is so much lower.

Steel.

Manufacturers of steel material are experiencing, as usual at this period of the year, a quiet turn in business, and few contracts of importance have been negotiated of late. In the semi-finished steel department there has been a noticeable decline in the prices of Continental material, but, in spite of this, buying on the part of British users has not been active, although some good inquiries have been circulated. It is evident that British consumers are acting cautiously and have little confidence in the present Continental price position. In finished steel buyers and sellers appear to have reached a deadlock, and, while there is a considerable tonnage of business offering at prices below the general level of market quotations, Continental manufacturers, for the most part, refuse to meet buyers' limits. The inquiry for tinplates has fallen off slightly, and the volume of business placed is less than it has been for some little time. The works, however, have good order books, and continue to be busily engaged.

Scrap.

With consuming works in the Northern area poorly occupied there has been only a limited demand for foundry scrap material, and at Middlesbrough this week prices are distinctly at weaker levels. Heavy cast iron and ordinary quality are quoted at 61s. per ton, while machinery scrap is still maintained at the 66s. level, at which it has stood unchanged for some months. In the Midlands, however, there is still a fair demand for heavy cast-iron machinery scrap in cupola sizes, and 65s. to 67s. 6d. delivered is offered, according to quality. Light cast-iron scrap is weak at 55s. delivered. At Glasgow and Falkirk there is no improvement in the cast-iron scrap market, and it is still difficult to find outlets, particularly for heavy machinery cast iron, at 66s. 6d. to 67s. 6d., with heavy ordinary cast-iron scrap at 5s. less. Light cast-iron scrap is still at 57s. 6d. per ton. The above prices are all per ton delivered f.o.t. consumers' works.

Metals.

Copper.—Values of warrant copper are well maintained at the steady levels recorded during the past few weeks, a position unlikely to be disturbed while consumptive demand retains its present consistency. Many of the principal consumers, whose stocks are known to be at a very low level, have doubtless awaited the publication of the American statistics for June before re-entering the market, and as these do not reveal any great accumulation of metal, it seems probable that current demand will register a further increase.

Closing quotations are:—

Cash.—Thursday, £62 16s. 3d. to £62 17s. 6d.; Friday, £62 18s. 9d. to £63; Monday, £62 17s. 6d. to £62 18s. 9d.; Tuesday, £62 16s. 3d. to £62 17s. 6d; Wednesday, £62 18s. 9d. to £63 1s. 3d.

Three Months.—Thursday, £63 2s. 6d. to £63 3s. 9d.; Friday, £63 5s. to £63 6s. 3d.; Monday, £63 3s. 9d. to £63 5s.; Tuesday, £63 2s. 6d to £63 3s. 9d.; Wednesday, £63 5s. to £63 6s. 3d.

Tin.—Though closing last week at somewhat firmer prices, the outlook for standard tin continues uncertain, and markets are irregular. Examination of the recently published June statistics revealed a somewhat more satisfactory position than had been anticipated, and produced a sharp rise in prices, but this was followed by a corresponding set-back as a result of heavy liquidation. At the close standard cash stood well above the previous week's quotations, although in some authoritative quarters it is still suggested that tin has yet to reach its lowest level for the present year.

Official closing prices:—

Cash.—Thursday, £209 to £209 2s. 6d.; Friday, £210 5s to £210 10s.; Monday, £210 5s. to £210 10s.; Tuesday, £213 to £213 5s.; Wednesday, £217 15s. to £217 17s. 6d.

Three Months. — Thursday, £205 10s. to £205 12s. 6d.; Friday, £206 15s. to £206 17s. 6d.; Monday, £207 to £207 5s.; Tuesday, £209 10s. to £209 12s. 6d.; Wednesday, £214 to £214 5s.

Spelter.—The market for ordinary spelter continues dull and featureless. Some sections of the galvanising trades are a little more active, but, on the whole, the demand has slackened off considerably. This is particularly the case on the Continent, although as yet Belgian producers are not making any special concessions in their efforts to attract business.

Daily quotations are:—

Ordinary.—Thursday, £25; Friday, £24 17s. 6d.; Monday, £24 11s. 3d.; Tuesday, £24 11s. 3d.; Wednesday, £24 11s. 3d.

Lead.—Fairly heavy arrivals of soft foreign pig have again been satisfactorily taken up, and quotations have been firm, with a slight upward tendency. Consumers' requirements are, perhaps, at a little lower level, but inquiry from Continental users is brisk.

Closing prices:—

Soft Foreign Prompt.—Thursday, £20 8s. 9d.; Friday, £20 8s. 9d.; Monday, £20 7s. 6d.; Tuesday, £20 10s.; Wednesday, £20 12s. 6d.

Six Months' Foreign Trade in Iron and Steel.

Imports.

The total imports of iron and steel and manufactures thereof during June (and the first six months of this year) amounted to 210,405 tons (1,542,299 tons), which compares with 332,637 tons and 2,570,271 tons respectively last year. The current year's values were £1,798,424 in June and £12,737,809 for the six months, as against £2,571,859 and £19,681,358 in the corresponding periods of last year. It will be noticed from these figures that the total imports of iron and steel during the past six months were approximately a million tons lower than in the corresponding period of last year.

The imports of some of the principal products during June (and in the six months) were as under:—

PIG-IRON.—Forge and foundry, 2,411 tons (32,807 tons); basic, 3,513 tons (32,937 tons); ferro-alloys, 1,491 tons (12,534 tons).

SEMI-PRODUCTS.—Steel ingots, 2,836 tons (36,615 tons); iron blooms, 632 tons (5,650 tons); steel blooms, 42,131 tons (330,181 tons); sheet and tinplate bars, 41,267 tons (284,066 tons); wire rods, 9,695 tons (65,038 tons).

FINISHED PRODUCTS.—Iron bars, 8,769 tons (90,471 tons); bright steel bars, 1,072 tons (4,479 tons); other steel bars, 25,388 tons (176,695 tons); special steel, 175 tons (1,076 tons); iron castings, 240 tons (1,295 tons); steel castings, 1,000 tons (5,975 tons); iron forgings, 273 tons (1,755 tons); steel forgings, 855 tons (6,564 tons); girders, 12,579 tons (73,417 tons); hoops and strip, 8,946 tons (74,900 tons); plates and sheets, 14,830 tons (108,432 tons); cast-iron pipes and fittings, 5,935 tons (25,038 tons); wrought-iron tubes and fittings, 5,361 tons (35,469 tons); railway rails, 861 tons (8,757 tons); wire, 5,212 tons (31,353 tons); wire nails, 5,509 tons (33,612 tons); unenumerated, 5,610 tons (32,584 tons).

Imports of iron ore were 441,207 tons (2,382,582 tons); and of scrap, 14,429 tons (27,344 tons).

Exports.

During June this country exported 365,890 tons of iron and steel, exclusive of scrap, compared with 366,050 tons in the corresponding month last year. The half-yearly figures (values in brackets) were 2,127,753 tons (£5,845,013) and 1,947,131 tons (£5,975,605) respectively. Exports of iron and steel during the six months were some 180,000 tons more than in the corresponding period of last year.

Some of the principal items of export in June (and six months) are appended:—

PIG-IRON.—Forge and foundry, 19,760 tons (119,000 tons); acid, 13,451 tons (72,849 tons); basic, nil (59 tons); ferro-alloys, 6,073 tons (27,899 tons).

SEMI-PRODUCTS.—Ingots, 119 tons (854 tons); blooms, billets, etc., 1,086 tons (3,335 tons); sheet bars, 167 tons (574 tons).

FINISHED PRODUCTS.—Iron bars, 2,232 tons (12,946 tons); steel bars, 29,520 tons (137,789 tons); special steel, 354 tons (2,202 tons); girders, etc., 6,859 tons (41,411 tons); hoops and strip, 6,176 tons (25,208 tons); plates not under ⅛ in., 10,808 tons (66,543 tons); black sheets, 32,734 tons (167,217 tons); black plates, 3,748 tons (14,494 tons); galvanised sheets, 54,167 tons (352,390 tons); tinplates, 54,615 tons (270,701 tons); cast pipes, 8,560 tons (56,544 tons); tubes, 22,478 tons (133,730 tons); tram rails, 331 tons (3,549 tons); railway rails, 25,388 tons (218,392 tons); sleepers and fishplates, 10,708 tons (55,256 tons); tyres and axles, 1,755 tons (11,779 tons); wire, 7,914 tons (40,754 tons); wire manufactures, 3,630 tons (22,364 tons); nails, 1,598 tons (9,128 tons); screws, 147 tons (1,333 tons); bolts and nuts, 2,427 tons (15,543 tons); stoves and grates, 1,709 tons (9,598 tons); anchors, etc., 1,352 tons (7,884 tons); bedsteads, 1,116 tons (6,217 tons); unenumerated, 24,121 tons (148,119 tons); scrap, 32,343 tons (191,345 tons).

U.S. Imports of Indian Pig-iron.—Of the total pig-iron imports of 133,068 tons into the United States during 1927, India supplied 66,627 tons, of which 63,810 tons were landed at Philadelphia. Great Britain supplied 21,129 tons, and 29,380 tons were shipped from the Netherlands, presumably in transport from Germany.

GUTMANN
ROTARY TABLE SAND BLAST

This new design embodies many important advantages.

No intermediate pipes are required between the sand blast apparatus and the machine.

The sand supply is wholly automatic.

Perfect separation of the used sand is ensured.

Complete freedom from *Dust*.

Standard type suitable for any pressure up to 45 pounds per square inch.

SPARE PARTS KEPT IN STOCK.
TECHNICAL ASSISTANCE ALWAYS AVAILABLE.
Sole Agents for Gt. Britain and Dominions
T. FEARNLEY ALLEN & SON,
51, Norwich Union Chambers, BIRMINGHAM.
Telegrams: "Sandblo," B'ham. Tel. No.: Cent. 543.

"Long Sought For —Now Found." FOUNDRITE TRADE MARK *THE MATERIAL.*

Found Right, and is the Only true Binding Material in Use ALL OVER THE WORLD. No Up-to-Date Foundry is Run without It. When you Try it Economy.

FOUNDRITE

Agents for:—
DORMAN LONG & CO., LTD.
"B.S. HEMATITE PIG-IRON."

CORE BINDER PREVENTS WASTERS.

SUPPLIED ONLY IN 40-GALLON CASKS.

HEDLEY MOORWOOD & Co., Ltd.,
FOUNDRY EXPERTS,
ROYAL INSURANCE BUILDINGS,
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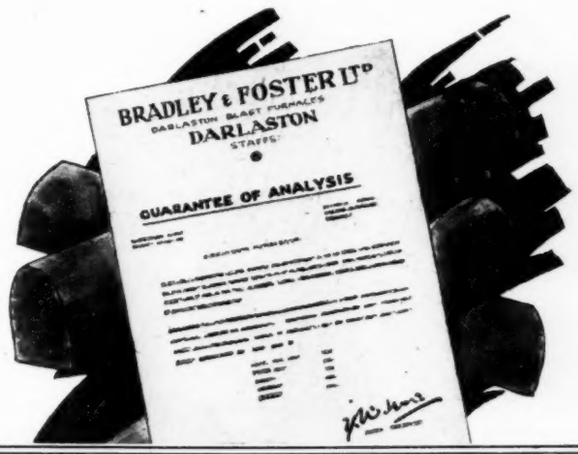
WHAT THE BRADLEY SERVICE MEANS TO THE FOUNDRYMAN. NO. 1.



THE SMALLEST CONSIGNMENT ANALYSED AND GUARANTEED

Foundrymen in the Midlands will be interested to know that in addition to Refined Pig Iron, Bradleys are able to supply from stock, various brands of Hematites, Scotch, Derbyshire, and Northampton Foundry Pig Iron, for mixing purposes.
The smallest consignment is carefully analysed and recorded and the exact quality can be guaranteed.

This is just an instance of the Bradley Service, giving full assurance to the small founder who wants, say a soft iron for his mixture. With the Bradley Service he gets what he wants and knows exactly what he has got, at very little more than he would pay for an ordinary quality sold without any guarantee. It pays to use the Bradley Service whether your requirements are big or small.

Bradley's REFINED PIG IRON

"A QUALITY FOR EVERY REQUIREMENT"

Write or 'phone for particulars of the Bradley range of Refined Pig Irons. Immediate attention is given to all enquiries and the knowledge and long experience of Bradley's is at the disposal of all foundrymen.

BRADLEY & FOSTER Ltd B&F DARLASTON, STAFFS.

WEEKLY PRICE CURRENT.

COPPER.

	£ s. d.
Standard cash	62 18 9
Three months	63 5 6
Electrolytic	68 15 0
Tough	65 10 0
Best selected	65 10 0
Sheets	94 0 0
India	76 10 0
Wire bars	69 0 0
Do. July	69 0 0
Do. August	69 0 0
Ingot bars	69 0 0
H.C. Wire rods	73 5 0
Off. av. cash, June	63 13 11½
Do. 3 mths., June	63 14 0½
Do., Sttlmnt., June	63 14 0½
Do., Electro, June	68 19 0½
Do., B.S., June	67 5 10
Aver. spot price, copper, June	63 13 11½
Do., Wire bars, June	69 3 4
Solid drawn tubes	13½d.
Brazed tubes	13½d.
Wire	10d.

BRASS.

Solid drawn tubes	11½d.
Brazed tubes	13½d.
Rods, drawn	10½d.
Rods, extd. or rlld.	7½d.
Sheets to 10 w.g.	10½d.
Wire	9½d.
Rolled metal	9½d.
Yellow metal rods	7½d.
Do. 4 × 4 Squares	8d.
Do. 4 × 3 Sheets	8½d.

TIN.

		£ s. d.
Standard cash		217 15 0
Three months		214 0 0
English		215 5 0
Bars		212 10 0
Straits	(Nom.)	220 15 0
Australian	(Nom.)	220 5 0
Eastern		210 15 0
Banca	(Nom.)	221 5 0
Off. av. cash, June		217 17 5½
Do., 3 mths., June		215 9 3½
Do., Sttlmt., June		217 7 0½
Aver. spot, June		217 7 5½

SPELTER.

	£ s. d.
Ordinary	24 11 3
Remelted	23 10 0
Hard	20 0 0
Electro 99.9	29 0 0
English	25 17 6
India	21 0 0
Zinc dust	33 0 0
Zinc ashes	8 0 0
Off. aver., June	25 10 11¼
Aver., spot, June	25 13 3½

LEAD.

	£ s. d.
Soft foreign ppt.	20 12 6
English	22 0 0
Off. average, June	21 1 11½
Average spot, June	20 19 8½

ZINC SHEETS, &c.

	£ s. d.
Zinc sheets, English	33 0 0
Do. V.M. ex whf.	31 10 0
Rods	39 0 0
Boiler plates	29 0 0
Battery plates	30 10 0

ANTIMONY.

	£ s. d.
Special brands, Eng.	59 10 0
Chinese	39 10 0
Crude	33 10 0

QUICKSILVER.

	£ s. d.
Quicksilver	21 6 3

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon—	
25%	£8 0 0
45/50%	£12 15 0
75%	£20 0 0
Ferro-vanadium—	
35/40%	14/3 lb. Va.
Ferro-molybdenum—	
70/75% c. free	4/6 lb. Mo.
Ferro-titanium—	
23/25% carbonless	1/2 lb.
Ferro-phosphorus, 20/25%	£18 0 0
Ferro-tungsten—	
80/85%, c. fr.	1/3½lb.
Tungsten metal powder—	
98/99%	1/7½ lb.
Ferro-chrome—	
2/4% car.	£32 0 0
4/6% car.	£22 0 0
6/8% car.	£21 12 6
8/10% car.	£21 0 0
Ferro-chrome—	
Max. 2% car.	£33 15 0
Max. 1% car.	£39 0 0
Max. 0.70% car.	£44 17 6
70%, carbonless	1/2 lb.
Nickel—99%, cubes or pellets	£175 0 0
Ferro-cobalt	9/- lb.
Aluminium 98/99%	£105 0 0
Metallic chromium—	
96/98%	2/8 lb.
Ferro-manganese (net)—	
76/80%, loose	£13 10 0
76/80%, packed	£14 10 0
76/80%, export	£13 5 0
Metallic manganese—	
94/96%, carbonless	1/6 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten	£0 2 3
Finished bars, 18% tungsten	£0 2 9

Per lb. net, d/d buyers' works.

Extras—	
Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to ⅛ in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ½ in.	3d. lb.
Do., under ½ in. × ¼ in.	1/-lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

Scrap from high-speed tool steel—	
Scrap pieces	3d.
Turnings and swarf	1d.

Per lb. net, d/d steel makers' works.

SCRAP.

	£ s. d.	£ s. d.
South Wales—		
Hvy. steel	3 8 0	
Bundled steel and shrngs.	3 2 6	to 3 5 0
Mixed iron and steel	3 0 0	to 3 2 6
Heavy cast iron	3 19 0	
Good machinery for foundries	3 3 0	
Cleveland—		
Heavy steel	2 14 0	
Steel turnings	2 8 6	
Cast iron borings	2 3 0	
Heavy forge	3 10 0	
Bushelled scrap	3 2 6	
Cast-iron scrap	3 1 6	to 3 6 0
Lancashire—		
Cast-iron scrap	3 0 0	
Hvy. wrought	2 17 6	
Steel turnings	2 2 6	

London—Merchants' buying prices delivered yard.

Copper (clean)	£52 0 0
Brass	£37 0 0
Lead (less usual draft)	£18 0 0
Tea lead	£16 0 0
Zinc	£16 0 0
New aluminium cuttings	£70 0 0
Braziery copper	£48 0 0
Gunmetal	£48 0 0
Hollow pewter	£150 0 0
Shaped black pewter	£105 0 0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast—	
Foundry No. 1	68/6
Foundry No. 3	66/-
Foundry No. 4	65/-
Forge No. 4	64/6
Hematite No. 1	69/-
Hematite M/Nos.	68/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	79/-
,, d/d Birm.	86/-
Midlands—	
Staffs. common*	67/6
,, No. 4 forge	57/-
,, No. 3 fdry.	60/-
Shrops. basic	—
,, Cold blast, ord.*	—
,, ,, roll iron*	—
* d/d Birmingham.	
Northants forge	52/6
,, fdry. No. 3	55/-
Derbyshire forge	59/-
,, fdry. No. 3	61/6
,, basic	61/-
Scotland—	
Foundry No. 1	75/-
,, No. 3	70/-
Hem. M/Nos.	74/-
Sheffield (d/d district)—	
Derby forge	62/6
,, fdry. No. 3	64/6
Lincs. forge	63/6
,, fdry. No. 3	64/6
E.C. hematite	81/-
W.C. hematite	84/-
Lincs. (at furnaces)—	
Forge No. 4	59/-
Foundry No. 3	60/-
Basic	59/-
Lancashire (d/d eq. Man.)—	
Derby forge	—
,, fdry. No. 3	68/-
Northants foundry No. 3	—
Dalzell, No. 3(special)	100/- to 102/6
Summerlee, No. 3	87/6
Glengarnock, No. 3	87/6
Gartsherrie, No. 3	87/6
Monkland, No. 3	87/6
Shotts, No. 3	87/6

FINISHED IRON AND STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£ s. d.	£ s. d.
Bars (cr.) nom.	9 10 0	to 10 15 0
Nut and bolt iron	8 12 6	to 8 15 0
Hoops	11 10 0	
Marked bars (Staffs.) f.o.t.	12 0 0	
Gas strip	11 10 0	
Bolts and nuts, ¾ in. × 4 in.	15 5 0	
Steel—		
Ship plates	8 7 6	
Boiler plts.	10 10 0	
Chequer plts.	10 12 6	
Angles	7 17 6	
Tees	8 17 6	
Joists	7 17 6	
Rounds and squares, 3 in. to 5½ in.	8 17 6	
Rounds under 3 in. to ¾ in. (Untested)	7 15 0	and upwards
Flats, over 5 in. wide and up	8 7 6	
Flats, 5 in. to 1½ in.	7 17 6	
Rails, heavy	8 10 0	
Fishplates	12 10 0	
Hoops (Staffs.)	10 0 0	
Black sheets, 24g.	10 0 0	
Galv. cor. shts., 24g.	13 10 0	
Galv. fencing wire 8g. plain	12 10 0	
Billets, soft	6 0 0	to 6 15 0
Billets, hard	7 2 6	to 7 12 6
Sheet bars	6 0 0	to 6 2 6
Tin bars	6 0 0	to 6 2 6

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	1 2½
Sheet to 10 w.g.	1 3
Wire	1 3½
Rods	1 3
Tubes	1 7½
Castings	1 2

Delivery 3 cwt. free.
10% phos. cop. £40 above B.S.
15% phos. cop. £50 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	per lb.
Ingots for raising	9d. to 1/3
Rolled—	
To 9 in. wide	1/3 to 1/9
To 12 in. wide	1/3½ to 1/9½
To 15 in. wide	1/3½ to 1/9½
To 18 in. wide	1/4 to 1/10
To 21 in. wide	1/4½ to 1/10½
To 25 in. wide	1/5 to 1/11
Ingots for spoons and forks	9d. to 1/5½
Ingots rolled to spoon size	1/- to 1/8½
Wire round—	
3/0 to 10 G.	1/6½ to 2/1½

with extras according to gauge.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2X foundry, Phila.	20.76
No. 2 foundry, Valley	16.75
No. 2 foundry, Birm.	15.50
Basic	17.76
Bessemer	18.76
Malleable	18.76
Grey forge	18.01
Ferro-mang. 80% d/d	105.00
O.-h. rails, h'y at mill	43.00
Bess billets	32.00
O.-h. billets	32.00
O.-h. sheet bars	32.00
Wire rods	42.00
	Cents.
Iron bars, Phila.	2.12
Steel bars	1.85
Tank plates	1.85
Beams, etc.	1.85
Skelp, grooved steel	1.85
Skelp, sheared steel	1.85
Steel hoops	2.20
Sheets, black, No. 24	2.65
Sheets, galv., No. 24	3.50
Sheets, blue an'l'd., 9 and 10	2.00
Wire nails	2.55
Plain wire	2.50
Barbed wire, galv.	3.35
Tinplates, 100 lb. box	$5.25

COKE (at ovens).

Welsh foundry	—
,, furnace	—
Durham and North.	
,, foundry	14/6 to 15/-
,, furnace	14/- to 14/3
Other Districts, foundry	—
,, ,, furnace (basis)	12/-

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. Cokes	20×14	box	18/4½
,,	28×20	,,	36/9
,,	20×10	,,	27/3
,,	18½×14	,,	19/-
C.W.	20×14	,,	17/-
,,	28×20	,,	34/-
,,	20×10	,,	22/-
,,	18½×14	,,	15/9
Terneplates	28×20		34/- per box basis f.o.b.

SWEDISH IRON.

Bars, hammered, £17 10 0	to £18 10 0
Rolled Ord. £15 0 0	to £15 10 0
Nail rods £15 7 6	to £15 15 0
Keg. steel nom.	£33 to £35
Faggot steel nom.	£22 to £25
Blooms, according to quality	£8 to £12
Pig-iron £5 15 0	to £6 0 0

all f.o.b. Gothenburg.

TUBES AND FITTINGS.

Up to and incl. 6 in.

	Tubes.	Fittings.
Gas	67½%	50%
Water	63½%	45%
Steam	60%	40%

W.I. 10% extra.

DAILY FLUCTUATIONS.

Standard Copper (cash).

	£	s.	d.		
July 12 ..	62	16	3	dec.	5/-
„ 13 ..	62	18	9	inc.	2/6
„ 16 ..	62	17	6	dec.	1/3
„ 17 ..	62	16	3	„	1/3
„ 18 ..	62	18	9	inc.	2/6

Electrolytic Copper.

	£	s.	d.		
July 12 ..	68	15	0	inc.	5/-
„ 13 ..	68	15	0	No change	
„ 16 ..	68	15	0	„ „	
„ 17 ..	68	15	0	„ „	
„ 18 ..	68	15	0	„ „	

Standard Tin (cash).

	£	s.	d.		
July 12 ..	209	0	0	dec.	10/-
„ 13 ..	210	5	0	inc.	25/-
„ 16 ..	210	5	0	No change	
„ 17 ..	213	0	0	inc.	55/-
„ 18 ..	217	15	0	inc.	95/-

Tin (English ingots).

	£	s.	d.		
July 12 ..	206	15	0	dec.	25/-
„ 13 ..	208	0	0	inc.	25/-
„ 16 ..	208	0	0	No change	
„ 17 ..	210	10	0	inc.	50/-
„ 18 ..	215	5	0	inc.	95/-

Zinc Sheets (English)

	£	s.	d.		
July 12 ..	33	0	0	dec.	15/-
„ 13 ..	33	0	0	No change	
„ 16 ..	33	0	0	„ „	
„ 17 ..	33	0	0	„ „	
„ 18 ..	33	0	0	„ „	

Spelter (ordinary).

	£	s.	d.		
July 12 ..	25	10	0	dec.	2/6
„ 13 ..	24	17	6	„	2/6
„ 16 ..	24	11	3	„	6/3
„ 17 ..	24	11	3	No change	
„ 18 ..	24	11	3	„	„

Lead (English).

	£	s.	d.		
July 12 ..	21	15	0	No change	
„ 13 ..	21	15	0	„	„
„ 16 ..	21	15	0	„	„
„ 17 ..	21	15	0	„	„
„ 18 ..	22	0	0	inc.	5/-

AVERAGE MONTHLY PRICES OF IRON HOOPS.

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1896	6 2 6	6 2 6	6 2 6	6 2 6	6 2 6	6 2 6	6 2 6	6 2 6	6 2 6	6 2 6	6 5 0	6 10 0	6 3 4
1897	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0
1898	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 15 0	6 15 0	7 0 0	6 11 8
1899	7 0 0	7 0 0	7 0 0	7 0 0	7 12 6	10 12 6	8 12 6	8 12 6	8 12 6	9 2 6	9 7 6	9 17 6	8 2 6
1900	9 17 6	10 7 6	10 7 6	10 7 0	10 12 6	7 12 6	10 12 6	10 12 6	10 12 6	9 17 6	9 2 6	9 2 6	10 3 9
1901	9 2 6	8 2 6	8 2 6	7 12 6	7 12 6	7 12 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 11 8
1902	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6
1903	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6
1904	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6
1905	6 17 6	7 0 0	7 0 0	7 0 6	7 0 0	7 0 6	7 2 6	7 2 6	7 2 6	7 2 6	7 0 0	7 7 6	7 2 6
1906	7 10 0	7 17 6	7 15 0	7 15 0	7 15 0	7 15 0	7 15 0	7 15 0	7 15 0	7 15 0	7 15 0	8 7 6	7 15 10
1907	8 7 6	8 7 6	8 7 6	8 7 0	8 7 6	8 7 6	8 10 0	8 10 0	8 10 0	8 5 0	8 5 0	8 0 0	8 7 1
1908	8 0 0	7 10 0	7 10 0	7 10 6	7 10 0	7 10 0	7 10 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 6 8
1909	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0
1910	7 1 10½	7 6 3	7 7 6	7 7 0	7 7 6	7 7 6	7 7 6	7 7 6	7 7 6	7 6 3	7 5 0	7 5 0	7 6 5½
1911	7 5 0	7 5 0	7 5 0	7 5 6	7 5 0	7 5 0	7 5 0	7 5 0	7 5 0	7 8 9	7 10 0	7 10 0	7 6 1½
1912	7 12 6	7 12 6	7 12 6	7 15 0	7 15 0	8 2 6	8 2 6	8 2 6	8 12 6	8 12 6	8 12 6	8 15 0	8 2 3½
1913	8 17 6	8 17 6	8 17 6	8 17 0	8 17 6	8 17 6	8 17 6	8 7 6	8 7 6	8 7 6	8 7 6	7 17 6	8 12 6
1914	7 17 6	7 17 6	7 17 6	7 13 9	7 12 6	7 12 6	7 12 6	9 2 6	9 2 6	9 2 6	9 2 6	9 2 6	8 6 4½
1915	9 3 6	9 18 1	10 7 6	10 16 6	10 17 6	13 2 6	13 2 6	13 2 6	13 7 6	14 2 6	15 2 6	15 18 6	12 10 1½
1916	17 2 6	17 2 6	17 2 6	17 6 3	17 7 6	17 7 6	17 7 6	17 7 6	17 7 6	17 7 6	17 7 6	17 7 6	17 6 1½
1917	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6
1918	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6	17 2 6
1919	17 2 6	17 2 6	17 2 6	17 2 6	24 6 3	24 6 3	24 6 3	25 9 0	26 7 6	26 7 6	26 7 6	26 17 4	22 14 9
1920	28 0 0	28 12 6	33 15 0	35 5 0	35 15 10	38 17 6	38 17 6	38 17 6	38 17 6	38 17 6	36 17 6	36 17 6	35 14 9
1921	29 1 3	23 5 0	21 12 6	20 0 0	20 0 0	20 0 0	17 5 0	15 0 0	14 4 0	13 15 0	13 10 0	12 18 0	17 5 10
1922	16 5 0	15 13 9	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	13 4 6½
1923	14 0 0	15 0 0	15 0 0	15 0 0	15 6 0	15 0 0	15 0 0	15 0 0	15 0 0	15 0 0	14 16 0	14 15 0	14 18 3½
1924	14 15 0	14 15 0	14 15 0	14 15 0	14 15 0	14 13 9	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 12 4½
1925	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0
1926	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0
1927	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	12 10 0	12 10 0	14 3 4
1928	12 10 0	12 7 6	12 0 0	11 13 6	11 15 0	11 12 6	—	—	—	—	—	—	—

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WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

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(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED.

FOREMAN required for Steel Foundry, capable of producing 100 tons of Light and Medium Castings per week; must be thoroughly acquainted with Machine Moulding practice; good organiser and strict disciplinarian; one used to Green Sand and Dry Sand Moulding and capable of fixing piecework prices; unless thoroughly experienced in all these branches applications will not be considered.—Reply, in confidence, stating age, experience and salary expected, to Box 766, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

FOUNDRY MANAGER.—Energetic man, with experience of modern Foundry practice, shortly disengaged; conversant with latest methods of mass production of Motor Cylinders, Crank Cases, etc.; references.—Box 758, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

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Treadle Guillotine Shearing Machine, to take 35 in. long.

New 14 in. swing APOLLO Combination Turret Lathe.

No. 14 "NATCO" Multiple Spindle Drilling Machine, arranged for 22 s.

"TULLIS" Horizontal Drilling and Tapping Machine, spindle 2¼ in. dia.

Ten splendid Horizontal Single Purchase STEAM WINCHES (Lidgerwood); cyls. 8¼ in. diam. x 8-in. stroke; brakes; cheap.

Two Powerful HORIZONTAL WORM-GEARED STEAM WINCHES (Clark Chapman); cylinders 10½ diam. x 10-in. stroke.

Two first-class Land-type W.I.F. WATER-TUBE BOILERS, by Babcock & Wilcox, Ltd., each with heating surface of 4,780 square feet and approximate evaporation 19,000 lbs. of water per hour; reinsurable at a working steam pressure of 200 lbs. per square inch, with Superheater, Chain Grate Stoker and Steam Fittings.

Large stock of very good second-hand FLAT-ENDED CIRCULAR BOILER STORAGE TANKS.

CATALOGUE (10,000 Lots) ON APPLICATION.

THOS. W. WARD LTD.,
ALBION WORKS, SHEFFIELD.

SAND MIXERS.—New and second-hand. Ask us to quote.—W. BREALEY & COMPANY, LIMITED, Prospect Works, Hawksley Avenue, Sheffield.

FOR SALE. Second-hand Moulding Machine for all classes of work, hand and power.—Apply Box 768, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

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MUST BE MOVED. PRACTICALLY NEW. BARGAINS.
By PNEULEC COMPANY.
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36 Pairs of Special MOULDING BOXES, for 12-ton latest specification Standard Split Axle Boxes.
36 Core Plates.
Cast-iron Pattern Plates with Mahogany Patterns and Core Boxes.
No. 4 Gas-fired Core Stove, 6 ft. x 9 ft. x 3 ft.; two compartments with thermometers.
FRANK JONES,
CAERAU CRESCENT, NEWPORT, MON.

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GANISTER, best quality, for Cupolas, also for Steel Works.—ASTBURY SILICA COMPANY, "The Brooms," Park Lane, Congleton.

PLUMBAGO.—To make room for large arrival middle of July, we offer 20 casks "Special" and 12 casks "Superfine" at 10 per cent. below price list (see our catalogue, page 8); unique opportunity.—WM. OLSEN, LIMITED, Hull.

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11 ACRES WORKS SITE, SHEFFIELD.
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Ganister or Silica Bricks and Blocks (any shape or size) **Sands, Cements, Ganister.**—*Let us have your enquiries*

THE CLEVELAND MAGNESITE & REFRACTORY CO., LTD.
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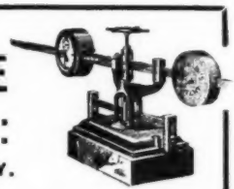

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800 lb. MORGAN Cokefired "A" type ..	£90

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BUY FROM ME AND SAVE MONEY.

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PROPRIETORS AND SHIPPERS OF
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SPECIAL FOUNDRY COKE
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Sulphur Content .... ·50% or under. **Ash .... 6% or under.**

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